Tecumseh

Hermetic Compressor

Service Data

TECUMSEH

TECUMSEH PRODUCTS COMPANY
TECUMSEH, MICHIGAN • MARION, OHIO • SOMERSET, KENTUCKY
LONDON, ONTARIO

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SERVICE
DATA BOOK

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LONDON, ONTARIO

INDEX

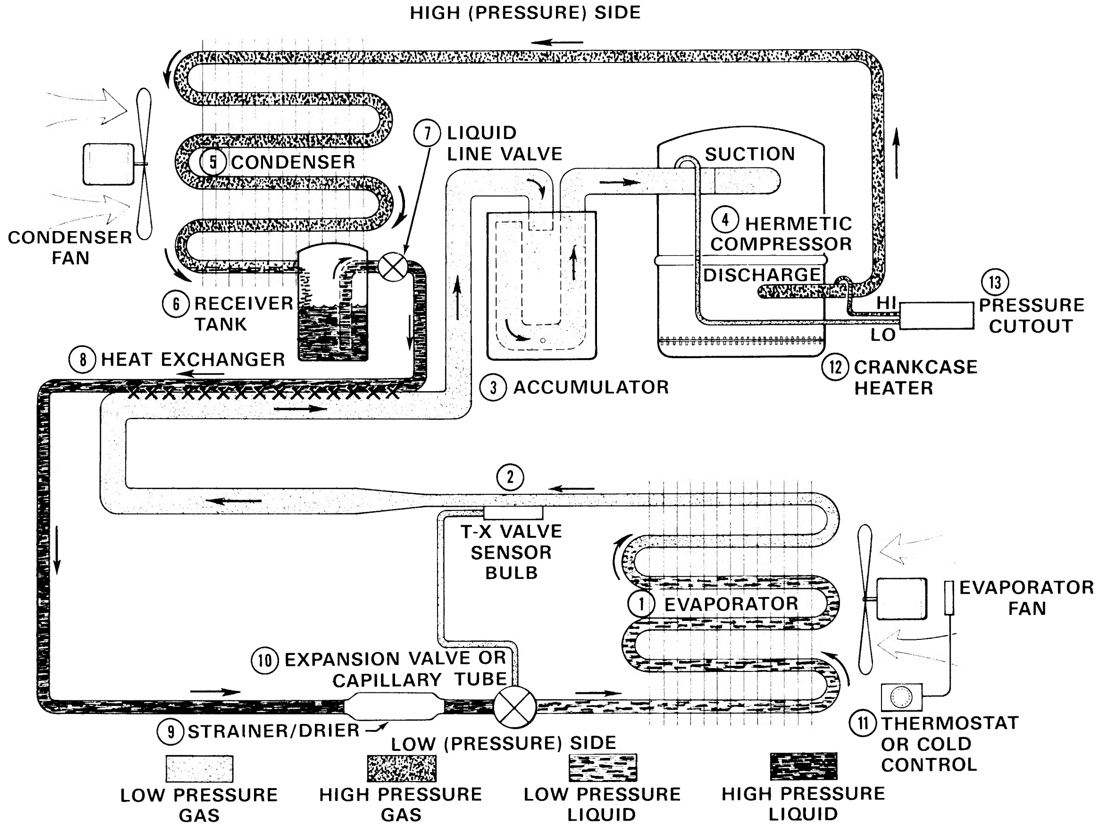
Page

Bleeder Resistors—Capacitor 36
Capillary Tube Sizing 58
Compressor Connections, Tubes 12
Compressor Cutaway and Definition 5
Compressor Motor Terminals 21
Compressor Types, Application,
  Refrigerant, Oil Charge 7
Contactors—List of Approved 26
Electrical Systems—How to Check 37
Electric Motors—Single Phase Types 23
Fuse Sizing 27
Line Sizing Tables 56
Motor Amps 24
Model Number Code—New 11
Motor Resistance Tables 31

Page

Mounting Compressor—Grommets 17
Overloads—External 28
Overloads—Internal 29
PSC Motor Installation and Service Tips 50
Pressure Drops in Lines 60
Relays, Current and Potential 30
Safety Tips 69
Serial Plate Information 6
Installation Pointers 15
System Clean-up after Motor Burn-out 66
Transformer Selection 27
Trouble Shooting Chart 71
Velocity in Refrigerant Lines 61
Warranty Comments 4
Wholesaler Compressor Testing Procedure 52

THE BASIC REFRIGERATION CYCLE



Mechanical refrigeration is accomplished by continuously circulating, evaporating, and condensing a fixed supply of refrigerant in a closed system. Evaporation occurs at a low temperature and low pressure while condensation occurs at a high temperature and pressure. Thus, it is possible to transfer heat from an area of low temperature (i.e., refrigerator cabinet) to an area of high temperature (i.e., kitchen).

Beginning the cycle at the evaporator inlet (1) the low pressure liquid expands, absorbs heat, and evaporates, changing to a low pressure gas at the evaporator outlet (2).

The compressor (4) pumps this gas from the evaporator through the accumulator (3), increases its pressure, and discharges the high pressure gas to the condenser (5). The accumulator is designed to protect the compressor by preventing slugs of liquid refrigerant from passing directly into the compressor. An accumulator should be included on all systems subjected to varying load conditions or frequent compressor cycling. In the condenser heat is removed from the gas which then condenses and becomes a high pressure liquid. In some systems this high pressure liquid drains from the condenser into a liquid storage or receiver tank (6). On other systems, both the receiver and the liquid line valve (7) are omitted.

A heat exchanger (8) between the liquid line and the suction line is also an optional item which may or may not be included in a given system design.

Between the condenser and the evaporator an expansion device (10) is located. Immediately preceding this device is a liquid line strainer/drier (9) which prevents plugging of the valve or tube by retaining scale, dirt and moisture. The flow of refrigerant into the evaporator is controlled by the pressure differential across the expansion device or, in the case of a thermal expansion valve, by the degree of superheat of the suction gas. Thus, the thermal expansion valve shown requires a sensor bulb located at the evaporator outlet. In any case, the flow of refrigerant into the evaporator normally increases as the evaporator load increases.

As the high pressure liquid refrigerant enters the evaporator it is subjected to a much lower pressure due to the suction of the compressor and the pressure drop across the expansion device. Thus, the refrigerant tends to expand and evaporate. In order to evaporate, the liquid must absorb heat from the air passing over the evaporator.

Eventually the desired air temperature is reached and the thermostat or cold control (11) will break the electrical circuit to the compressor motor and stop the compressor.

As the temperature of the air through the evaporator rises, the thermostat or cold control remakes the electrical circuit. The compressor starts, and the cycle continues.

In addition to the accumulator, a compressor crankcase heater (12) is included on many systems. This heater prevents accumulation of refrigerant in the compressor crankcase during the non-operating periods and prevents liquid slugging or oil pump-out on start-up.

Additional protection of the compressor and system is afforded by a high and low pressure cutout (13). This control is set to stop the compressor in the event that the system pressures rise above or fall below the design operating range.

Other controls not indicated on the basic cycle which may be part of a system include: evaporator pressure regulators, hot gas by pass regulators, electric solenoid valves, suction pressure regulators, condenser pressure regulators, low side or high side float refrigerant controllers, oil separators, etc.

It is extemely important to analyze completely every system and understand the intended function of each component before attempting to determine the cause of a malfunction or failure.

INTRODUCTION

The purpose of this data book is to provide the refrigeration and air conditioning service engineer with helpful information concerning the installation and servicing of Tecumseh compressors.

The manual is not an air conditioning or refrigeration system textbook.

Tecumseh compressors are purchased and installed by hundreds of independent equipment manufacturers in many types of end products. Each manufacturer, because of his own design and application, publishes service information specifically applicable to his product. Wherever possible, the service procedures and recommendations of the end product manufacturer should be followed.

The information in this Tecumseh Service Data Book is generally confined to the compressor and to items and conditions affecting the installation, operation and servicing of the compressor.

GENERAL WARRANTY

Tecumseh Products Company assumes certain well defined responsibilities relative to any improper workmanship and material which may occur in products manufactured by it.

These responsibilities are specifically stated in the Tecumseh Products Company Warranty and General Policy, *both of which are extended directly to and limited to the end product manufacturer.*

The owners of end products containing Tecumseh compressors and *service engineers servicing such products are urged to acquaint themselves with the warranty provisions of the end product manufacturer.*

Tecumseh Products Company reserves the right to make changes in design, or to make additions to, or improvement in its products without imposing any obligation on itself to install on its products previously manufactured.

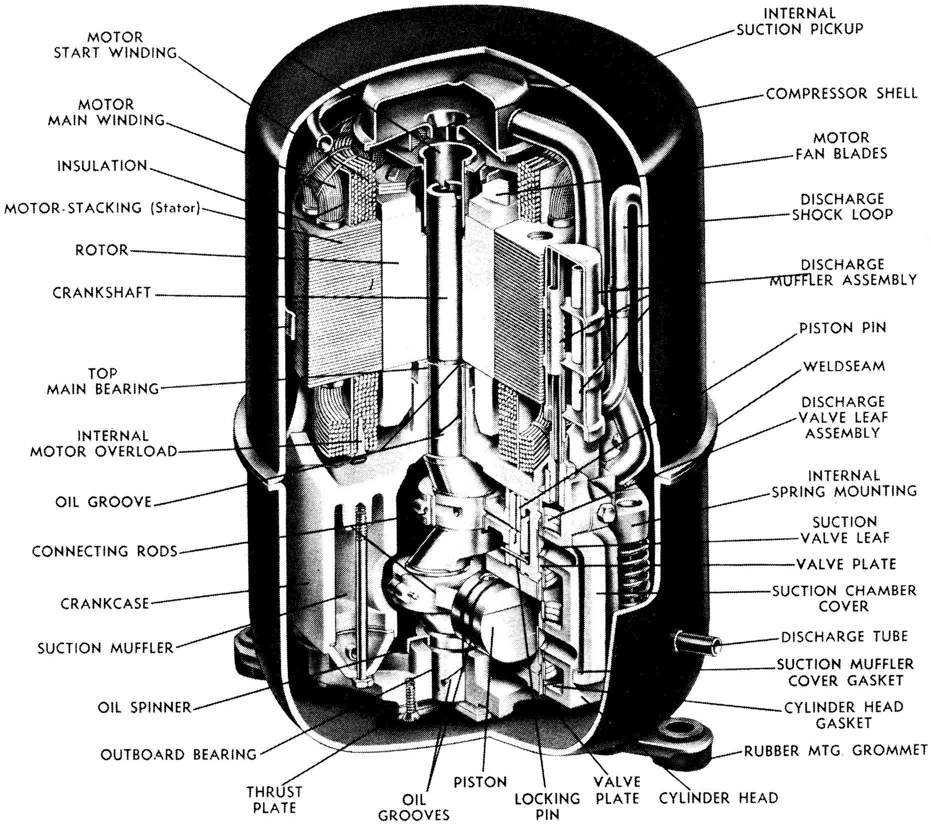
What is a Tecumseh Hermetic Compressor

A direct-connected motor compressor assembly enclosed within a steel housing and designed to pump low pressure refrigerant gas to a higher pressure.

Tecumseh hermetic compressors are all of the low pressure shell or housing type. This means that the compressor housing interior is subjected to suction pressure only and not to the discharge pressure created by the stroke of the piston. This point is emphasized in order to stress the hazard of introducing high pressure gas into the compressor shell at pressures above 150 PSIG.

The major internal parts of a Tecumseh hermetic compressor are listed in the same sequence as that of the refrigerant gas flow through the compressor. First the suction is drawn into the compressor shell, then to and through the electric motor which provides power to the crankshaft. The crankshaft revolves in its bearings, driving the piston (s) in the cylinder(s). The crankshaft is designed to carry oil from the oil pump in the bottom of the compressor to all bearing surfaces. Refrigerant gas surrounds the compressor crankcase and motor as it is drawn through the compressor shell and into the cylinder(s) through the suction muffler and suction valves. As the gas is pressured by the moving piston; it is released through the discharge valves, discharge muffler and compressor discharge tube.

Many Tecumseh hermetic compressors contain internal motor protectors— the details of these are covered in a separate section of this manual.



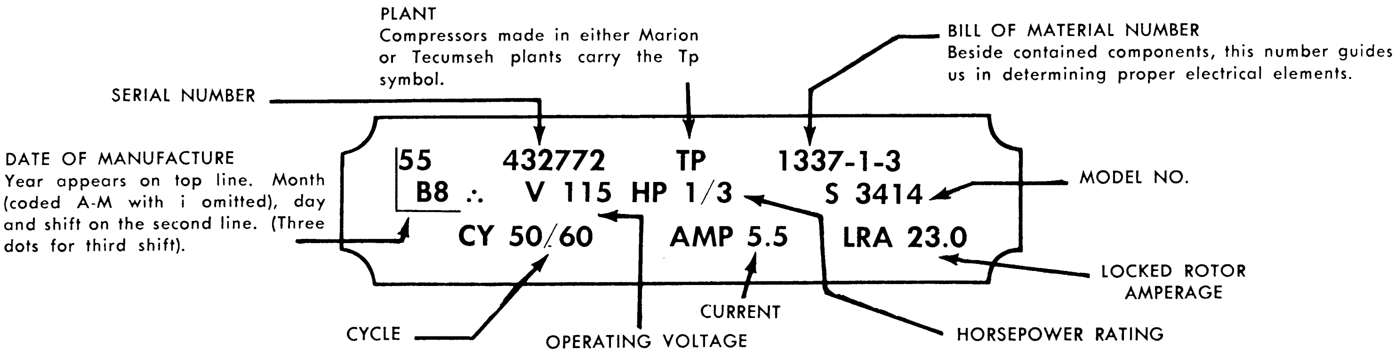
Model AH

Internal View of Typical Air Conditioning Compressor

SERIAL PLATE INFORMATION

The only source for complete compressor information is on the compressor serial plate. This plate is usually spot-welded on the upper shell of the compressor and describes the compressor characteristics exactly.

TYPICAL SERIAL PLATE 1953-1958



PLANT
Compressors made in either Marion or Tecumseh plants carry the Tp symbol.

BILL OF MATERIAL NUMBER
Beside contained components, this number guides us in determining proper electrical elements.

SERIAL NUMBER

DATE OF MANUFACTURE
Year appears on top line. Month (coded A-M with i omitted), day and shift on the second line. (Three dots for third shift).

MODEL NO.

LOCKED ROTOR AMPERAGE

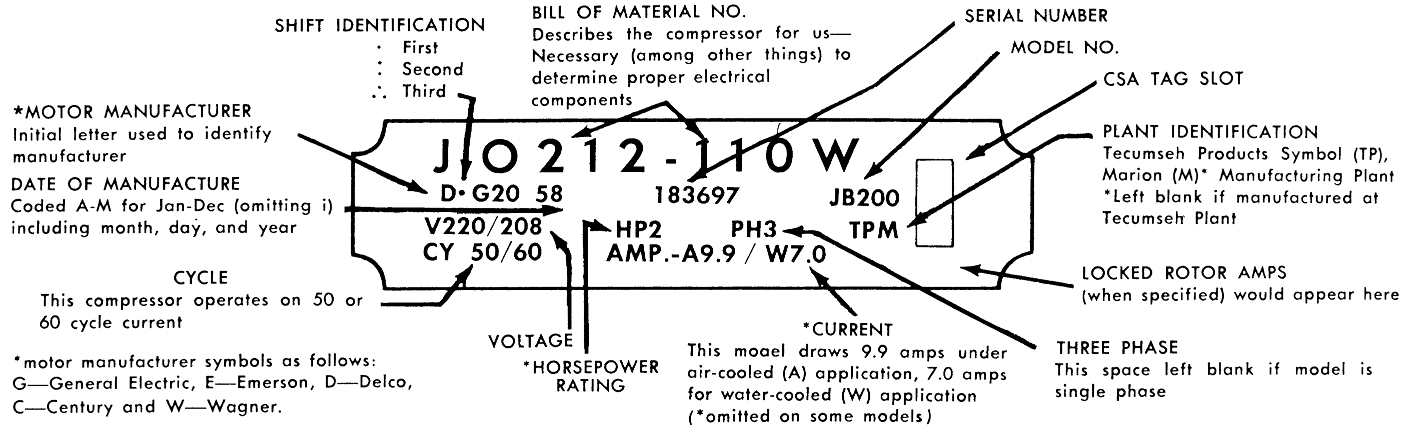
CURRENT

CYCLE

OPERATING VOLTAGE

HORSEPOWER RATING

TYPICAL SERIAL PLATE 1958-1964 (AUGUST)



SHIFT IDENTIFICATION
· First
: Second
∴ Third

BILL OF MATERIAL NO.
Describes the compressor for us—Necessary (among other things) to determine proper electrical components

SERIAL NUMBER

MODEL NO.

CSA TAG SLOT

*MOTOR MANUFACTURER
Initial letter used to identify manufacturer

DATE OF MANUFACTURE
Coded A-M for Jan-Dec (omitting i) including month, day, and year

PLANT IDENTIFICATION
Tecumseh Products Symbol (TP), Marion (M)* Manufacturing Plant
*Left blank if manufactured at Tecumseh Plant

LOCKED ROTOR AMPS
(when specified) would appear here

CYCLE
This compressor operates on 50 or 60 cycle current

VOLTAGE

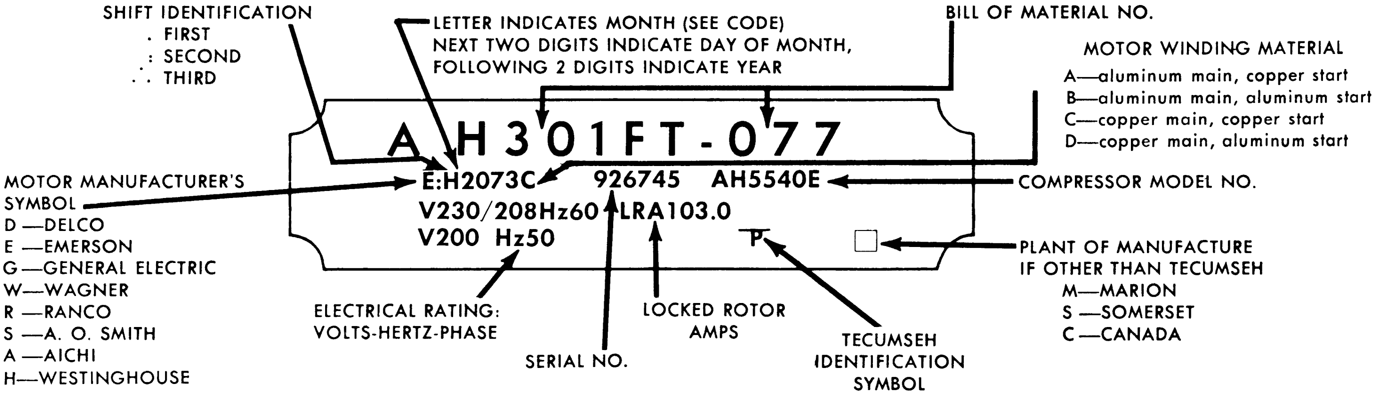
*HORSEPOWER RATING

*CURRENT
This model draws 9.9 amps under air-cooled (A) application, 7.0 amps for water-cooled (W) application
(*omitted on some models)

THREE PHASE
This space left blank if model is single phase

*motor manufacturer symbols as follows:
G—General Electric, E—Emerson, D—Delco, C—Century and W—Wagner.

TYPICAL CURRENT SERIAL PLATE



SHIFT IDENTIFICATION
. FIRST
: SECOND
∴ THIRD

LETTER INDICATES MONTH (SEE CODE)
NEXT TWO DIGITS INDICATE DAY OF MONTH,
FOLLOWING 2 DIGITS INDICATE YEAR

BILL OF MATERIAL NO.

MOTOR WINDING MATERIAL
A—aluminum main, copper start
B—aluminum main, aluminum start
C—copper main, copper start
D—copper main, aluminum start

MOTOR MANUFACTURER'S SYMBOL
D —DELCO
E —EMERSON
G—GENERAL ELECTRIC
W—WAGNER
R —RANCO
S —A. O. SMITH
A —AICHI
H—WESTINGHOUSE

COMPRESSOR MODEL NO.

PLANT OF MANUFACTURE IF OTHER THAN TECUMSEH
M—MARION
S —SOMERSET
C —CANADA

ELECTRICAL RATING:
VOLTS-HERTZ-PHASE

SERIAL NO.

LOCKED ROTOR AMPS

TECUMSEH IDENTIFICATION SYMBOL

DATE OF MANUFACTURE

The date of manufacture is determined by a code on the serial plate or unit nameplate. This code is as follows:

Starting in January 1940 the date designation on all hermetic compressors was simplified to one letter and one figure. The months are lettered as follows:

January—A
February—B
March—C
April—D
May—E
June—F
July—G
August—H
September—J
October—K
November—L
December—M

Preceding this letter is a numeral indicating the year this compressor was built. For example, 1A would indicate the compressor was built January 1941, 7C would indicate the compressor was built March 1947. This system will hold for compressors manufactured from 1940 through 1949.

For compressors manufactured from 1950 to 1952, the year precedes the letter designating the month. For example, 51L is a compressor manufactured in November 1951. From 1953 to 1958 the year is the first numeral and the month and day are on the second line.

From 1958 on, the second line reading from left to right is: Letter indicating motor, dots to identify shift, letter for month, 2 digits for day and 2 digits for year of manufacture.

Compressor Types

Since Tecumseh introduced the first welded hermetic compressor in 1937, over 115 million have been produced.

This 115 million includes many types and styles of compressors differing widely from each other in appearance, application and service.

It is necessary to be able to identify and understand these differences in order to provide proper service. The Tecumseh **Electrical Service Parts Guide Book** contains detailed wiring diagrams and cross reference data which when used with this Service Manual will supply the service engineer with information that will assist him in the proper identification, application and servicing of most Tecumseh compressors.

The following is a list of new and obsolete Tecumseh compressors by model number, indicating refrigerant used, approximate size by horsepower or BTU/hr. rating, application and oil charge.

Application Ranges

Air Cond. = +32°F to +55°F
A.C. (Hi Eff.) = +32°F to +57°F
Ht. Pump* = −10°F to +55°F
*Approved Models Only

HBP = +20°F to +55°F
MBP = −10°F to +30°F
LBP (Norm. Torque) = −30°F to +10°F
LBP (High Torque) = −40°F to +10°F

Pancake Compressors

Model	H.P.	Application	Refrigerant	Oil Charge oz.	Model	H.P.	Application	Refrigerant	Oil Charge oz.
P2019	1/20	LBP	R-12	22	P5312	1/5	LBP	R-12	22
P1218	1/12	LBP	R-12	22	AP5111	1/5	LBP	R-12	22
P1219	1/12	LBP	R-12	22	AR43	1/4	LBP	R-12	22
P91	1/8	LBP	R-12	22	AP43	1/4	LBP	R-12	22
P61	1/6	HBP	R-12	22	AP4111	1/4	HBP	R-12	22
P6112	1/6	LBP	R-12	22	CAP4111	1/4	HBP	R-12	22
P5112	1/5	HBP	R-12	22	AP3311	1/3	HBP	R-12	22
P5311	1/5	HBP	R-12	22	CAP3311	1/3	HBP	R-12	22

"T" & "AT" Compressors

Model	H.P.	Application	Refrigerant	Oil Charge oz.	Model	H.P.	Application	Refrigerant	Oil Charge oz.
T63	1/6	LBP	R-12	38	AT34	1/3	HBP	R-12	32
T53	1/5	HBP	R-12	38	AT35	1/3	LBP	R-12	32
T55	1/5	LBP	R-12	38	AT3512	1/3	LBP	R-12	32
AT5C	1/5	LBP	R-12	32	CAT3J12	1/3	LBP	R-12	32
AT43	1/4	LBP	R-12	32	CAT34	1/3	HBP	R-12	32
AT4C	1/4	HBP	R-12	32	CAT35	1/3	LBP	R-12	32
CAT43	1/4	LBP	R-12	32	CAT3512	1/3	LBP	R-12	32
CAT4C	1/4	HBP	R-12	32					

"AE" Compressors

New Model	Old Model	BTU/ Hr.	Application	Refrigerant	Oil Chrg. oz.	New Model	Old Model	BTU/ Hr.	Application	Refrigerant	Oil Chrg. oz.
AE1320A	AE20Z5	200	LBP	R-12	10	AE3417A	AE5ZA9	1850	HBP	R-12	20
AE1332A	AE12Z7	320	LBP	R-12	10	AE3425A	AE59ZF9	2600	HBP	R-12	20
AE1336A	AE8ZA7	360	LBP	R-12	10	AE3430A	AE41ZF11	3100	HBP	R-12	23
AE1343A	AE6ZD7	430	LBP	R-12	10	AE4430A	CAE41	3100	HBP	R-12	23
AE1360A	AE5ZF9	600	LBP	R-12	20	AE3440A	None	4100	HBP	R-12	16
AE1380A	AE4ZF11	800	LBP	R-12	23	AE4440A	None	4100	HBP	R-12	16
AE1410A	None	1000	LBP	R-12	16*	AE5455E	None	5500	AC	R-22	10
AE1411E	None	1100	LBP	R-22	16	AE5460E	None	6000	AC	R-22	10
AE1413A	None	1300	LBP	R-12	16*	AE5465E	None	6500	AC	R-22	10
AE1415E	None	1500	LBP	R-22	16	AE5465F	None	6500	AC	R-22	10
AE3414A	AE6ZA7	1450	HBP	R-12	10	AE5470E	None	7000	AC	R-22	10
						AE8475E	AE5465F	7500	AE (HE)	R-22	10

*Special Oil

"AK" Compressors

Model	BTU/Hr.	Application	Refrigerant	Oil Charge oz.	Model	BTU/Hr.	Application	Refrigerant	Oil Charge oz.
AK5470E	7000	AC	R-22	17	AK5510E	10000	AC	R-22	17
AK5483E	8300	AC	R-22	17	AK5511E	11000	AC	R-22	17
AK5494E	9400	AC	R-22	17	AK5512E	12000	AC	R-22	17

"AB" Compressors

Model	BTU/Hr.	Application	Refrigerant	Oil Charge oz.	Model	BTU/Hr.	Application	Refrigerant	Oil Charge oz.
AB5519F	19000	AC	R-22	36	AB5522F	22000	AC	R-22	36
AB5520F	20300	AC	R-22	36	AB5524F	24000	AC	R-22	36

"AU" & "AR" Compressors

Model	H.P.	Application	Refrigerant	Oil Charge oz.	Model	H.P.	Application	Refrigerant	Oil Charge oz.
AR26	1/2	AC	R-12	22	AU1M12	1	AC	R-22	30
AU3	1/2	AC	R-22	30	AU1612	1	AC	R-22	30
AU4	1/2	AC	R-22	30	AU1P12	1	AC	R-22	30
AU14	1/2	AC	R-22	30	AU1P13	1	AC	R-22	30
AU24	1/2	HBP	R-12	30	AUR13	1 1/4	AC	R-22	30
AU16	3/4	AC	R-22	30					

"ISM" Compressors

Model	H.P.	Application	Refrigerant	Oil Charge oz.	Model	H.P.	Application	Refrigerant	Oil Charge oz.
S84	1/8	LBP	R-12	40	C3414	1/3	LBP	R-22	40
S88	1/8	LBP	R-12	40	S3614	1/3	HBP	R-12	40
S68	1/6	LBP	R-22	40	S3N14	1/3	HBP	R-12	45
S68	1/6	HBP	R-12	40	C3N14	1/3	HBP	R-12	45
S64	1/6	LBP	R-12	40	S3N16	1/3	LBP	R-12	45
S6814	1/6	LBP	R-12	40	C3N16	1/3	LBP	R-12	45
S58	1/5	HBP	R-12	40	S3R16	1/3	LBP	R-12	45
S54	1/5	LBP	R-12	40	C3R16	1/3	LBP	R-12	45
S5814	1/5	HBP	R-12	40	S2614	1/2	HBP	R-22	45
S5414	1/5	LBP	R-12	40	S2N16	1/2	LBP	R-22	45
S4614	1/4	LBP	R-12	40	S2S16	1/2	HBP	R-12	45
C4614	1/4	LBP	R-12	40	S2N14	1/2	HBP	R-22	45
S4414	1/4	HBP	R-12	40	S6N14	1/2	HBP	R-22	45
C4414	1/4	HBP	R-12	40	S2R16	1/2	HBP	R-12	45
S4416	1/4	LBP	R-12	40	S2T16	1/2	HBP	R-12	45
C4416	1/4	LBP	R-12	40	S7N16	3/4	HBP	R-22	45
S4814	1/4	LBP	R-22	40	S7R16	3/4	HBP	R-22	45
S4N14	1/4	LBP	R-12	45	S1T16	1	HBP	R-22	45
C4N14	1/4	LBP	R-12	45	AS1T16	1	HBP	R-22	45
S3814	1/3	HBP	R-22	40	S8N16	1	HBP	R-22	45
S3414	1/3	LBP	R 22	40					

"AH" Compressors

New Model	Old Model	BTU/ Hr.	Application	Refrigerant	Oil Chrg. oz.	New Model	Old Model	BTU/ Hr.	Application	Refrigerant	Oil Chrg. oz.
AH2435A	None	3500	LBP	R-12	45	AH5530E	AH31S13	30000	AC	R-22	45
AH2445A	None	4500	LBP	R-12	45	AH5531E	None	31000	AC	R-22	45
AH2466A	None	6600	LBP	R-12	45	AH5531F	AH31T13	31000	AC	R-22	45
AH4518A	AH20S13	18000	HBP	R-12	45	AH5534E	AH34X13	34000.	AC	R-22	45
AH4525A	None	25000	HBP	R-12	45	AH5540E	AH40X15	40000	AC	R-22	45
AH5519E	None	19400	AC	R-22	45	AH7480A	None	8000	MBP	R-12	45
AH5520E	AH20L12	19500	AC	R-22	45	AH7511A	None	11000	MBP	R-12	45
AH5522E	AH22M12	22000	AC	R-22	45	AH7511B	None	11000	MBP	R-12	45
AH5524E	AH24P12	24000	AC	R-22	45	AH7514A	None	14000	MBP	R-12	45
AH5527E	AH28Q13	27100	AC	R-22	45						

Note: 55 oz. when used on units or when interconnected.

"B," "C" Compressors

Model	H.P.	Application	Refrigerant	Oil Charge oz.
B3411	1/3	LBP	R-12	45
B3811	1/3	HBP	R-12	45
B2413	1/2	HBP	R-12	45
B2513	1/2	HBP	R-12	45
B2513	1/2	LBP	R-22	45
C2513	1/2	HBP	R-12	45
C2513	1/2	LBP	R-22	45
C2516	1/2	MBP	R-12	45
B2616	1/2	LBP	R-12	45
C2616	1/2	LBP	R-12	45
B2813	1/2	MBP	R-22	45
C2L16	1/2	LBP	R-12	45
B2L16	1/2	LBP	R-12	45
B7616	3/4	HBP	R-12	45
B7616	3/4	LBP	R-22	45
C7616	3/4	HBP	R-12	45
C7616	3/4	LBP	R-22	45
B7613	3/4	HBP	R-12	45
B7516	3/4	HBP	R-12	45
B7T16	3/4	LBP	R-12	45
B8413	1	AC	R-22	45

Model	H.P.	Application	Refrigerant	Oil Charge oz.
C7T16	3/4	LBP	R-12	45
C7P16	3/4	MBP	R-12	45
B7413	3/4	HBP	R-22	45
B1516	1	HBP	R-22	45
B1613	1	HBP	R-22	45
B8513	1	HBP	R-22	45
B1P16	1	LBP	R-22	45
B1T16	1	H&MBP	R-22	45
B1U18	1	LBP	R-12	45
B1616	1	HBP	R-22	45
B32P16	1 1/2	HBP	R-22	45
B32M16	1 1/2	HBP	R-22	45
B32U18	1 1/2	HBP	R-22	45
B32516	1 1/2	HBP	R-22	45
B74T16	1 3/4	HBP	R-22	45
B21T18	2	HBP	R-22	45
B21U18	2	HBP	R-22	45
B02A	2	HBP	R-22	45
B02B	2	HBP	R-22	45
BB5512E	1	AC	R-22	45

"AJ" Compressors

New Model	Old Model	BTU/ Hr.	Application	Refrigerant	Oil Chrg. oz.
AJ1411E	AJ438	1100	LBP	R-22	30
AJ1414E	AJ3E	1400	LBP	R-22	30
AJ2416A	CAJ3612	1600	LBP	R-12	30
AJ2416B	CAJ3P	1600	LBP	R-12	30
AJ1420E	AJ26	2000	LBP	R-22	30
AJ2425A	CAJ2T12	2500	LBP	R-12	30
AJ2425B	CAJ2R13	2500	LBP	R-12	30
AJ4443A	CAJ34	4350	HBP	R-12	30
AJ4461A	CAJ2612	6100	HBP	R-12	30
AJ4461B	CAJ2P	6100	HBP	R-12	30
AJ4492A	CAJ7R13	9150	HBP	R-12	30
AJ4512A	None	12000	HBP	R-12	30
AJ5460E	AJ3	6000	AC	R-22	26
AJ5465E	AJ2L8	6500	AC	R-22	26
AJ5470E	AJ4	7050	AC	R-22	26
AJ5471E	AJ14	7050	AC	R-22	26
AJ5478E	None	7800	AC	R-22	26
AJ5483E	AJ16	8300	AC	R-22	26
AJ5494E	AJ1P	9400	AC	R-22	26
AJ5510E	AJ1612	10000	AC	R-22	26
AJ5510F	AJ1Q	10000	AC	R-22	26
AJ5511E	AJ1M12	11000	AC	R-22	26

New Model	Old Model	BTU/ Hr.	Application	Refrigerant	Oil Chrg. oz.
AJ5511F	AJ1R	11500	AC	R-22	26
AJ5511G	AJ1S	11500	AC	R-22	26
AJ5512E	AJ1P12	11900	AC	R-22	26
AJ5512F	AJ1T	11900	AC	R-22	26
AJ5512G	None	12300	AC	R-22	26
AJ5513E	AJ1P13	13200	AC	R-22	26
AJ5513F	AJ1R12	13200	AC	R-22	26
AJ5515E	AJR13	15000	AC	R-22	26
AJ5515F	AJT12	15000	AC	R-22	26
AJ5517E	AJR15	17200	AC	R-22	26
AJ5518E	AJT15	18500	AC	R-22	26
AJ5519E	None	19300	AC	R-22	26
AJ5519G	None	19300	AC	R-22	26
AJ6435A	AJ2612	3500	MBP	R-12	26
AJ7441A	None	4100	MBP	R-12	30
AJ7465A	None	6500	MBP	R-12	30
AJ7465B	None	6500	MBP	R-12	30
AJ8494E	AJ5478E	9400	AC (HE)	R-22	26
AJ8514E	AJ5512G	14000	AC (HE)	R-22	26
AJ8516E	AJ5514E	16300	AC (HE)	R-22	26
AJ8520E	AJ5517G	19500	AC (HE)	R-22	26

"CL" Compressors

New Model	Old Model	BTU/ Hr.	Application	Refrigerant	Oil Chrg. oz.
	CL25X12	31000	AC	R-22	45
	CL26Y14	22000	HBP	R-12	55
	CL26ZA14	25000	HBP	R-12	55
	CL26X12	31000	AC	R-22	45
	CL30Y14	38000	AC	R-22	45
CL4532A	CL31ZC17	32000	HBP	R-12	55
	CL31ZH17	35000	HBP	R-12	55
CL5538E	CL31Y14	38000	AC	R-22	45*

New Model	Old Model	BTU/ Hr.	Application	Refrigerant	Oil Chrg. oz.
CL5540E	CL32ZA14	40000	AC	R-22	45
	CL35ZC14	44000	AC	R-22	45
CL5544E	CL36ZC14	44000	AC	R-22	45
	CL40ZA17	51000	AC	R-22	45
CL5550E	CL41ZA17	50000	AC	R-22	45*
CL5562E	CL51ZH17	62000	AC	R-22	45*

*65 oz. when used on units or interconnected.

"H," "J," & "PJ" Compressors

Model	H.P.	Application	Refrigerant	Oil Charge oz.
HA75	3/4	LBP	R-12	55
JA75	3/4	LBP	R-12	55
HA100	1	HBP	R-12	55
HB100	1	LBP	R-12	55
JA100	1	HBP	R-12	55
HA150	1 1/2	HBP	R-22	55
JA150	1 1/2	HBP	R-22	55
HB150	1 1/2	HBP	R-12	55
JB150	1 1/2	HBP	R-12	55
JE150	1 1/2	LBP	R-12	55
JG150	1 1/2	MBP	R-12	55
HB200	2	HBP	R-22	55
HD200	2	HBP	R-12	55
HC200	2	HBP	R-22	55
JB200	2	HBP	R-22	55
JE200	2	HBP	R-12	55
JG200	2	LBP	R-22	55
HD300	3	HBP	R-22	55
JE300	3	HBP	R-22	55
JG300	3	HBP	R-22	55
PJE300	3	HBP	R-22	55
PJG300	3	HBP	R-22	55
JE301	3	HBP	R-22	55
PJE301	3	HBP	R-22	55
PJG301	3	HBP	R-22	55

"F" & "PF" Compressors

Model	H.P.	Application	Refrigerant	Oil Charge oz.
FD200	2	LBP	R-12	165
FE300	3	LBP	R-12	165
FB300	3	HBP	R-12	115
FE400	4	HBP	R-12	115
PFB400	4	HBP	R-22	115
PFB403	4	HBP	R-22	115
FB500	5	HBP	R-22	115
PFB500	5	HBP	R-22	115
FB503	5	HBP	R-22	115
PFB503	5	HBP	R-22	115

Tecumseh Hermetic Compressor Oil

Approved Brands

Suniso 3GS
Texas Capella B   Texas Capella B Inhibited

Tecumseh compressors are factory charged with an approved grade of refrigeration oil. This charge is more than ample for most self-contained systems and close coupled remote systems.

Where remote systems using our recommended tube sizes exceed 35 feet in length of suction and discharge line, additional oil should be added in the amount of three fluid ounces for each additional ten feet of run over 35 feet total. This additional oil is required for tube wetting and accumulation in traps.

If oil must be added, it should be introduced through the compressor suction. An approved oil injector pump may be used or, if none is available, then oil can be drawn by vacuum into a refrigerant charging tank, refrigerant added to pressurize tank, and then oil may be forced into suction by turning charging tank upside down.

If a compressor in transit or storage tips over and loses oil, we recommend that all oil be drained and a measured new oil charge added.

Caution—Do not overcharge with oil.

Tecumseh Products Company
Compressor and Condensing Unit
New Model Number Code

Effective: September 1, 1966

EXAMPLE USED TO EXPLAIN DEFINITION: AE3425AA

AE3425A—High Temperature Normal Torque—2500 BTU/HR—Original Release R-12—Air Cooled Capillary Application—Condensing Unit.

	NEW	OLD
Compressor	A E 3 4 2 5 A	A E 5 9 Z F 9
Condensing Unit	A E 3 4 2 5 A A	A E 5 9 H
Definition	1 2 3 4 5 6	

DEFINITION:

1. Compressor Family: AE, AK, AJ, AH, CL, AB, etc.

2. Application:

1.	L.B.P.	(−10°F.)	Normal Torque Motor
2.	L.B.P.	(−10°F.)	High Torque Motor
3.	H.B.P.	(+45°F.)	Normal Torque Motor
4.	H.B.P.	(+45°F.)	High Torque Motor
**5.	Air Cond.		Normal Torque Motor
6.	M.B.P.	(+20°F.)	Normal Torque Motor
7.	M.B.P.	(+20°F.)	High Torque Motor
8.	Air Cond.	(+49°F.)	High Efficiency Compressor
9.	Unassigned		

**Application 5 Compressors applied to condensing units:
1. Compressor model number will remain application 5
2. Unit model number will change to application 3 or 4
Example: A condensing unit using an AH5524E compressor (CSR) would have a unit model number AH4524EC.

3. Total Number of Digits in Rated 60 Hz Capacity of Compressor
4. Rated Capacity Reduced to Two Significant Numbers.
5. Variant and First Approved Refrigerant:

A B C D	R-12
E F G H	R-22
J K L	R-502
M N P R S T U V W X Y Z	Unassigned

6. Condensing Unit Features—See Chart and **.

UNASSIGNED LETTERS: E, F, G, H, J, K, L, N, P R, U, V, Z The Letters I, O and Q are eliminated.	Fan Cooled	Water Cooled	Air-Water Cooled	Receiver Tank	BX Cable	Interconnect Comp.	See BM	
A. Standard Unit	*							
B. Std. Unit W/Receiver Tank	*			*				
C. Std. Unit W/Tank & BX Cable	*			*	*			
D. Std. Unit W/BX Cable	*				*			
W. Water Cooled Unit		*		*	*			
X. Interconnect Unit	*			*	*	*		
Y. Air-Water Cooled Unit			*		*			
T. Interconnect Compressor						*		
S. Customer Special							*	
M. Bulk Milk Cooler Unit							*	

Compressor Connections, Tubes

Tecumseh Products Company supplies compressors to hundreds of manufacturers requiring different tubing sizes and arrangements. Because of this the same compressor model may be found in the field in many suction and discharge variations, each depending upon the specific application in which it is installed.

Suction connections can usually be identified as the largest diameter stub tube in the housing. If 2 stubs have the same O.D., then the one with the heavier wall will be the suction connection. If both of the largest stub tubes are the same O.D. and wall thickness, then either can be used as the suction connection although the one farthest from the terminals is preferred.

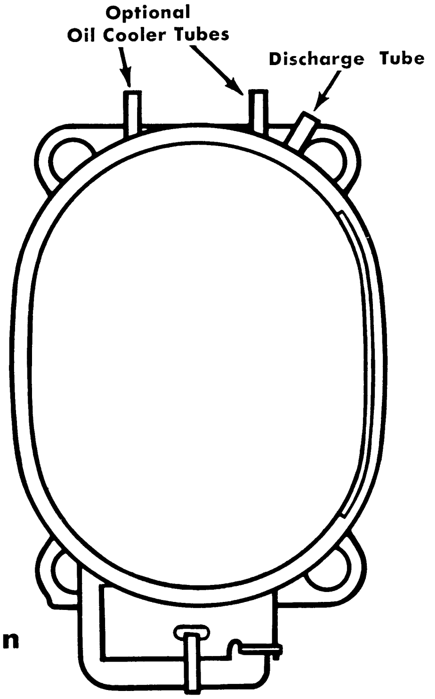
The stub tube, not chosen for the suction connection, may be used for processing the system.

Identification of compressor connections can usually be accomplished without difficulty; however, occasionally some question arises concerning oil cooler tubes and process tubes.

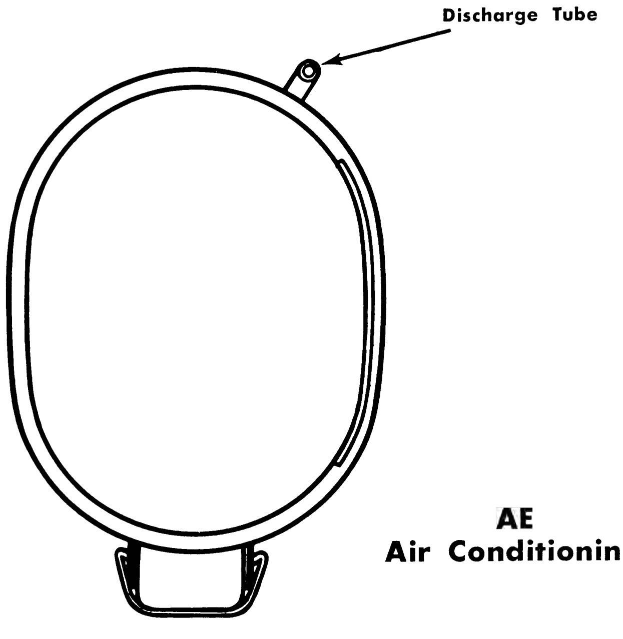
Oil cooler tubes are found only in low temperature refrigeration models. These tubes connect to a coil or hairpin bend within the compressor oil sump. This coil or hairpin bend is not open inside the compressor and its only function is to cool the compressor sump oil. The oil cooler tubes are most generally connected to an individually separated tubing circuit in the air cooled condenser.

Process Tubes—are installed in compressor housings at the factory as an aid in factory dehydration and charging. These can be used in place of the suction tube (if) they are of the same diameter and wall thickness as the suction tube.

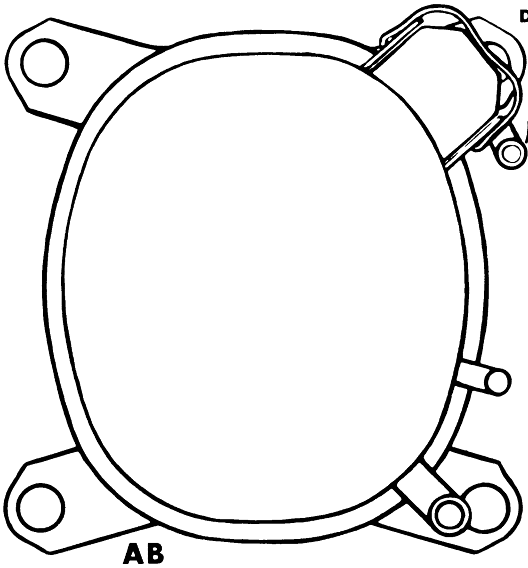
Standard discharge tubing arrangements for Tecumseh hermetic compressors are outlined below. Discharge tubes are generally in the same position within any model family. Suction and process tube positions may vary substantially.



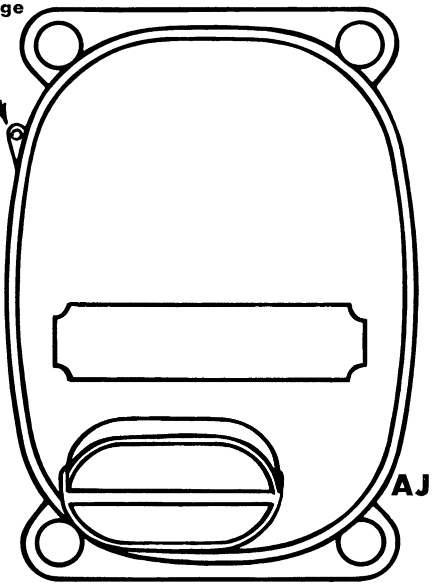
AE Refrigeration



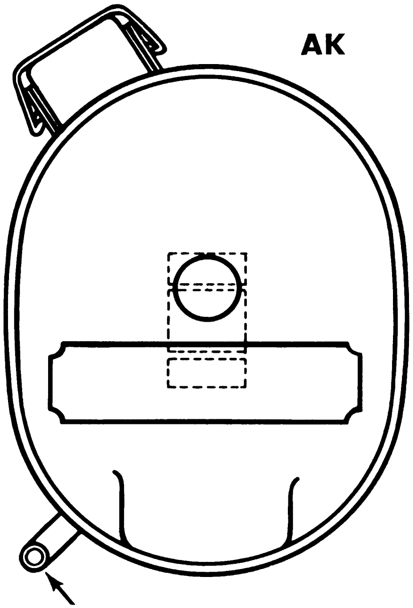
AE Air Conditioning



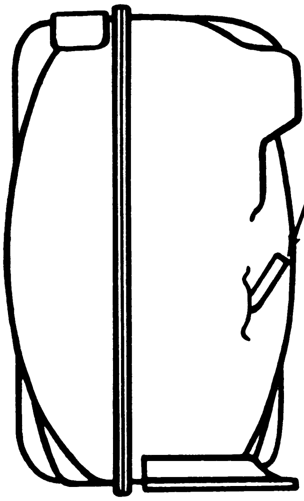
AB



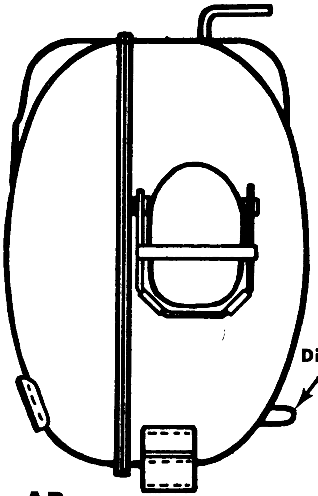
AJ



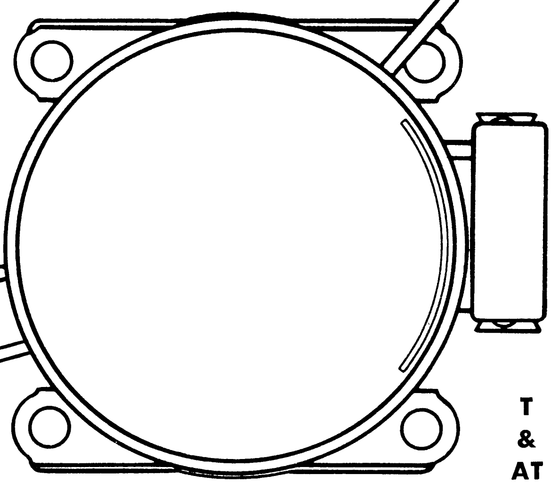
AK



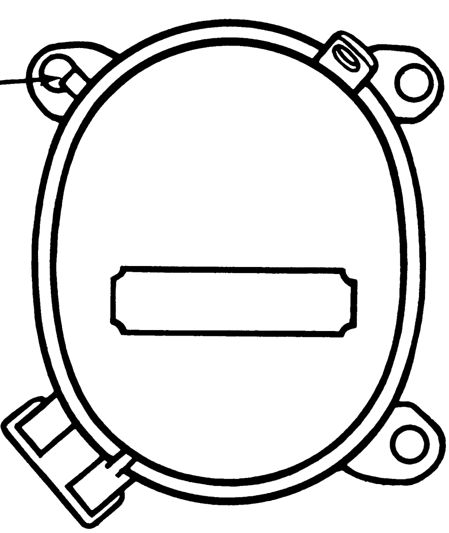
AU



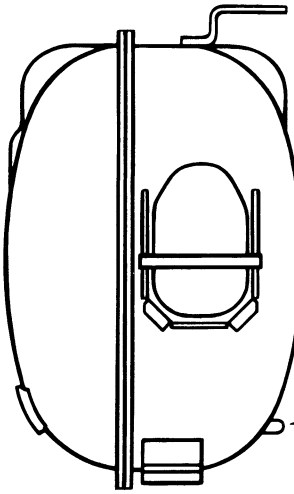
AR



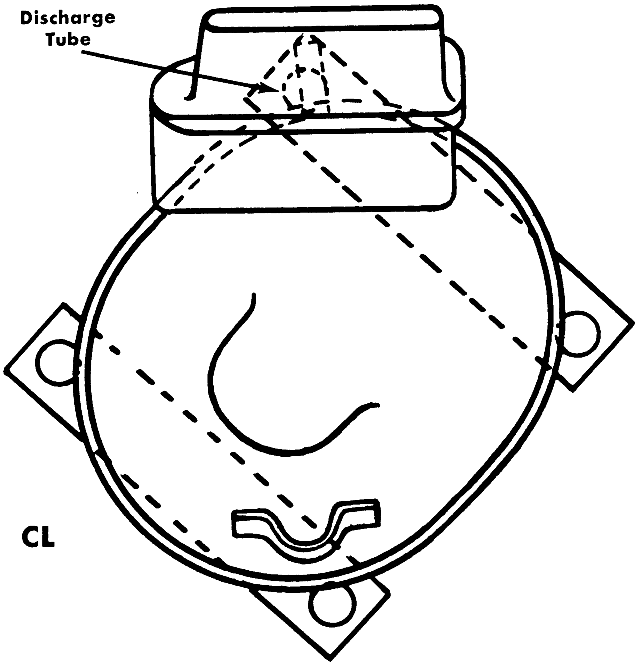
**T
&
AT**



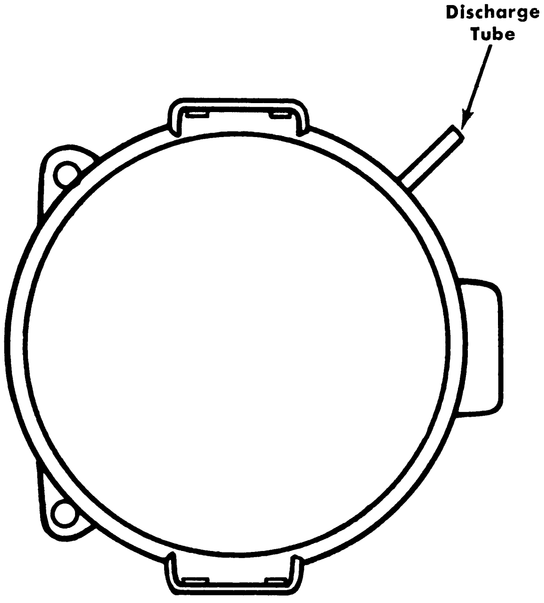
AH



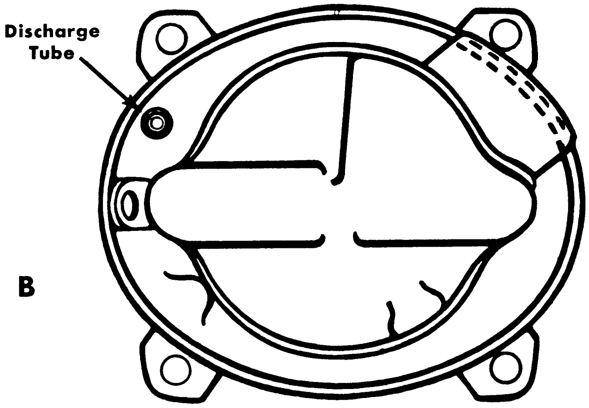
P



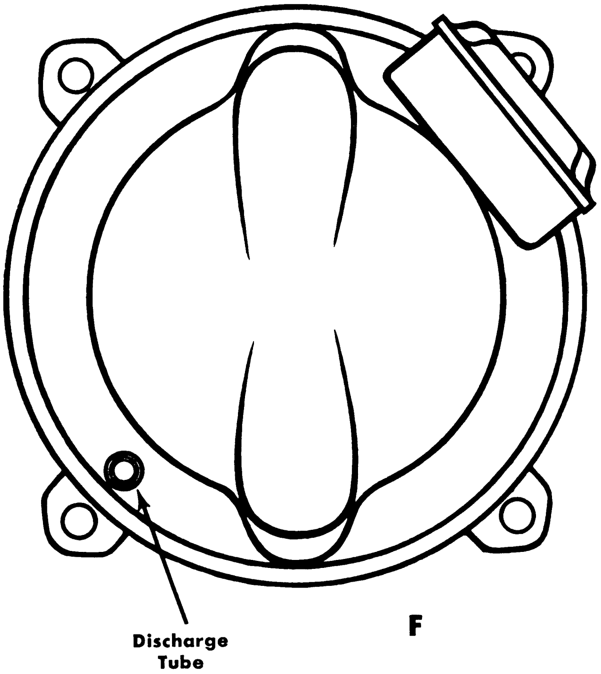
CL



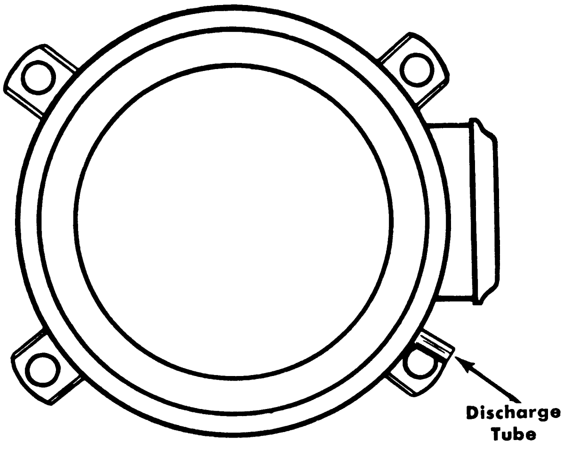
ISM



B



F



J

NOTE: Whenever possible, suction connections should be kept away from compressor electrical terminal area so that condensation will not drip on terminals, causing corrosion and/or electrical shorts.

Installation Pointers

(See Cleanup After Burnout Recommendations Page 66.)

Solder and Joint Making:

Caution—Your Tecumseh compressor suction, discharge and process tubes have been factory soldered to the compressor housing with silver solder. This solder has a melting point of 1125°F. and a flow point of 1295°F. When making system solder joint, care should be taken to direct the torch flame away from the housing joint. Where short stub tubes are involved, it is good practice to cool the tube root area with a wet cloth during soldering.

Good Techniques:

1. Use clean, dehydrated, refrigeration tubing purchased with both ends sealed.
2. Cut and form tubes carefully to avoid getting dirt or metal particles into the refrigeration lines.
3. When you open the system, complete the work as quickly as possible so the system will not be exposed to the air longer than necessary.
4. Use Silver Solder or Silfoss for all tubing solder connections.
5. Use frostproof flare nuts.
6. Never use compressor to assist in evacuating system. Use a good vacuum pump.
7. Save and replace all valve leak caps—Keep them clean.

Internal Pressure Relief Valves

Certain air conditioning compressors in the AJ, AH, and CL families are equipped with a unique internal pressure relief valve (IPR valve).

The IPR valve is a safety device for the air conditioning system to prevent abnormally high head pressures from developing in the event of a failed condenser fan motor or blocked air passages in the condenser coil because of dirt, leaves, paper, etc.

The IPR valve will also open to relieve hydraulic pressures in the event of slugging. This is apt to occur on start up if refrigerant has been allowed to migrate to the compressor crankcase.

It is a characteristic of the IPR valve that once it has "popped" it will not reset until the compressor has been stopped and the pressure allowed to equalize.

If a high to low side leak within the compressor is suspected, stop the system, equalize the pressures, permit the IPR valve to close, and restart the compressor to double check before deciding to change the compressor.

Application Ranges

Tecumseh compressors and condensing units are designed for specific evaporator temperature ranges. These ranges are generally defined as:

Low temperature = −40° F to +10° F
Medium temperature = −10° F to +30° F
High temperature = +20° F to +55° F
Air conditioning = +32° F to +55° F

Asking a compressor or condensing unit to operate outside its design temperature range could lead to trouble. Consider these problem areas:

Motors—

A low temperature compressor placed on a high temperature application will probably run out of motor. It may not start. If it starts, it may stall under load. It will pull high amps and could trip the overload.

High temperature compressors normally pump a lot of gas and need relatively large motors to do so. Such a compressor when operated on a low temperature application will run a hot motor. Even though the return gas temperature may be cooler than design conditions, the amount of refrigerant (pounds per hour) circulating over the motor will be inadequate to properly cool it.

Valves

A low temperature compressor operated at high evaporator temperature will demonstrate poor pumping efficiencies. Its port sizes and valve openings will be too small for the much larger refrigerant gas flows (pounds per hour) of the higher temperatures.

On the other hand, a high temperature compressor operating at low evaporator temperatures will try to beat its valve leaves to pieces. The valves will experience a much lesser resistance to their closing than for which they were designed and will slap against the seats. Metal fatigue and breakage are likely to occur.

The capacities of high temperature compressors also fall off rapidly when operated below their normal evaporator temperature. They usually do not enjoy the design niceties built into low temperature compressors to improve volumetric efficiencies by such means as reducing piston blow by and minimizing head clearance volume.

Some high temperature designs have a cylinder reexpansion volume which is quite OK at design conditions but which is so large (relatively speaking) that it won't pump at all at very low evaporator temperatures. Do not project capacity curves downward—you could be fooled!

Sound—

Internal tubing and mufflers are "tuned" for the design operating conditions. If a compressor is operated outside its normal application range it is likely that a tuning mismatch will occur. Objectionable noise and disruptive discharge line pulsations could result.

Overloads—

Overloads will not be correctly calibrated if operated outside of the design evaporator range and thus motor protection could be lost. External overloads sense a combination of motor amps and shell temperature and thereby deduce motor winding temperature. A high temperature compressor operating at low evaporator temperatures will pull much lower amps than that which the overload was calibrated for. The overload may not trip even though the motor is burning up because of the reduced return gas flow over the motor and the added motor inefficiencies.

Use only specified overloads.

Crankcase Heat

When most air conditioning and commercial systems are started up for the first time, a large part of the system refrigerant charge is in the compressor. On startup, the refrigerant boils off taking the oil charge with it, and the compressor is forced to run for as long as 3 or 4 minutes until the oil charge circulates through the system and returns to the crankcase.

Obviously this is not good for the compressor and definitely shortens its service life.

The solution is to charge the system so that little or no refrigerant collects in the crankcase and to operate the crankcase heater *at least 12 hours* before start up or after a prolonged shutdown.

Two types of crankcase heaters are in common use on Tecumseh compressors; wrap-around resistance heater (belly band) and the run capacitance off-cycle heat.

The wrap-around heater should be strapped to the housing below the oil level and in close contact with the housing. A good heater will maintain the oil at least 10° F. above the temperature of any other system component and (when the compressor is stopped) desirably at or above a minimum temperature of 80° F.

In the run capacitance off-cycle heat method, single phase compressors are stopped by opening only one leg (L_1) and thus the other power supply leg (L_2) to the run capacitor remains "hot". A trickle current through the start windings results thereby warming the motor windings, and thus the oil, on the "off-cycle".

Pull the disconnect switch before working on such systems.

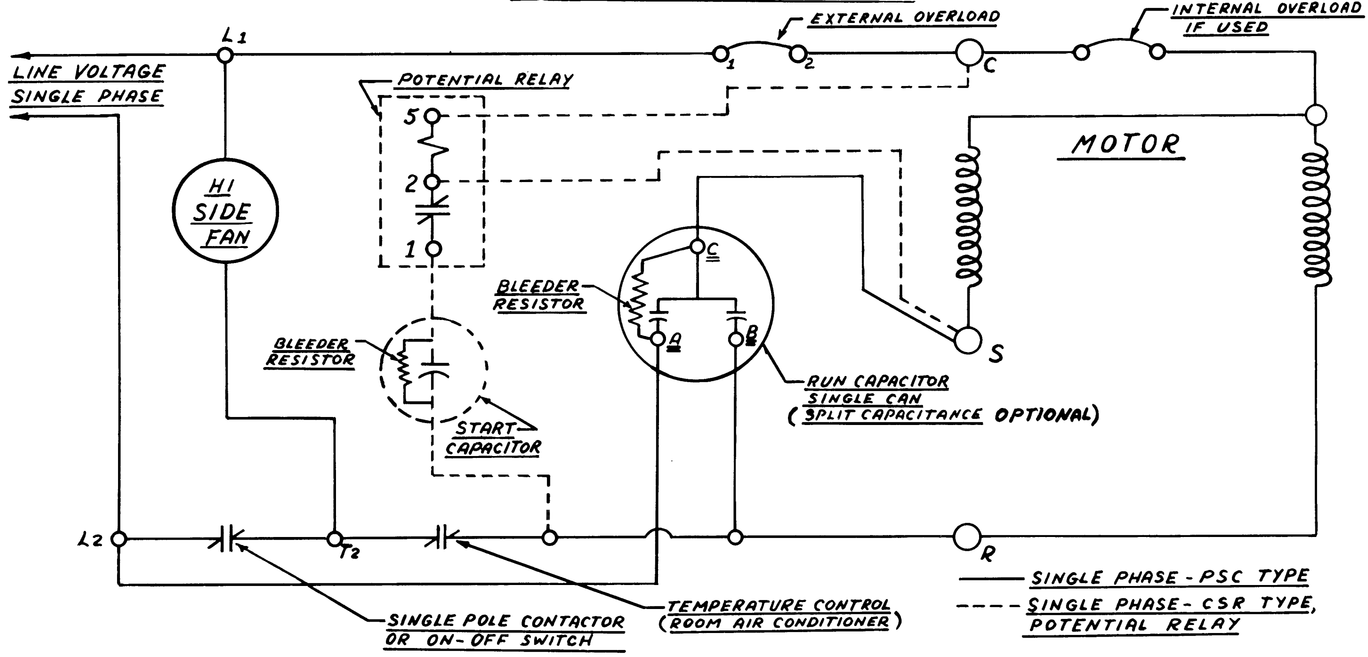
Capacitance crankcase heat systems can be recognized by one or more of the following:

1. Contactor or thermostat breaks only one leg to the compressor (and condenser fan).
2. Equipment should carry a notice indicating power is on compressor when it is not running and that main breaker should be opened before servicing.
3. Run capacitor is sometimes split (3 terminals) so that only part of the capacitance is used for off cycle heating.

CAUTION: Use exact replacement when changing such dual purpose run capacitors. Capacitor must be fused and carry a bleed resistor across the terminals.

Basic wiring diagram for PSC compressor with run capacitance off-cycle heat is:

SINGLE PHASE CSR OR PSC TYPE WITH INTERNAL OR EXTERNAL LINE BREAK OVERLOADS

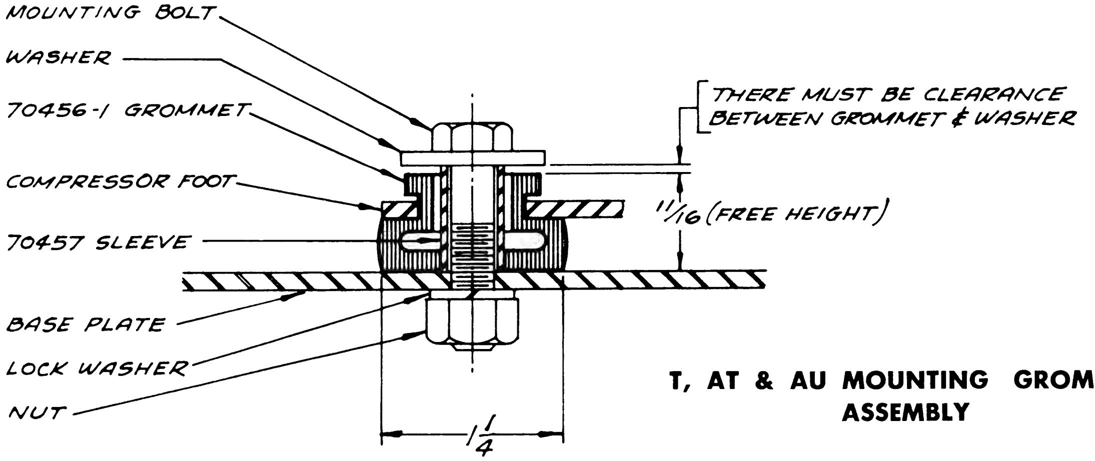

L1
LINE VOLTAGE
SINGLE PHASE
EXTERNAL OVERLOAD
1
2
C
INTERNAL OVERLOAD IF USED
POTENTIAL RELAY
5
2
1
MOTOR
HI SIDE FAN
BLEEDER RESISTOR
C
A
B
S
RUN CAPACITOR SINGLE CAN (SPLIT CAPACITANCE OPTIONAL)
BLEEDER RESISTOR
START CAPACITOR
L2
T2
R
SINGLE POLE CONTACTOR OR ON-OFF SWITCH
TEMPERATURE CONTROL (ROOM AIR CONDITIONER)
—— SINGLE PHASE - PSC TYPE
---- SINGLE PHASE - CSR TYPE, POTENTIAL RELAY

Compressor Mounting

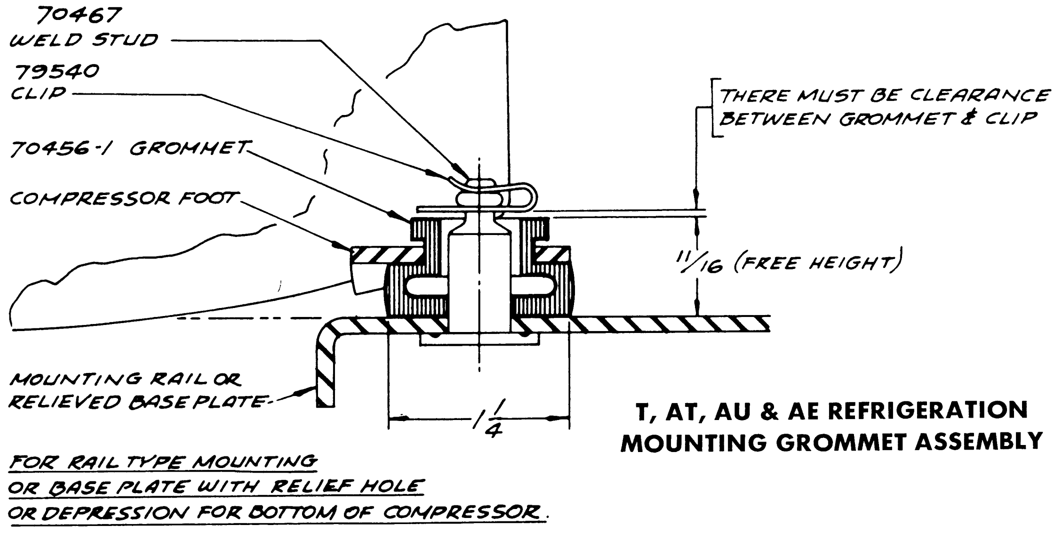
Compressor mountings are designed to achieve several results:

1. Reduce vibration transmission.
2. Secure compressor during shipment.
3. Cushion horizontal thrust when compressor starts or stops.

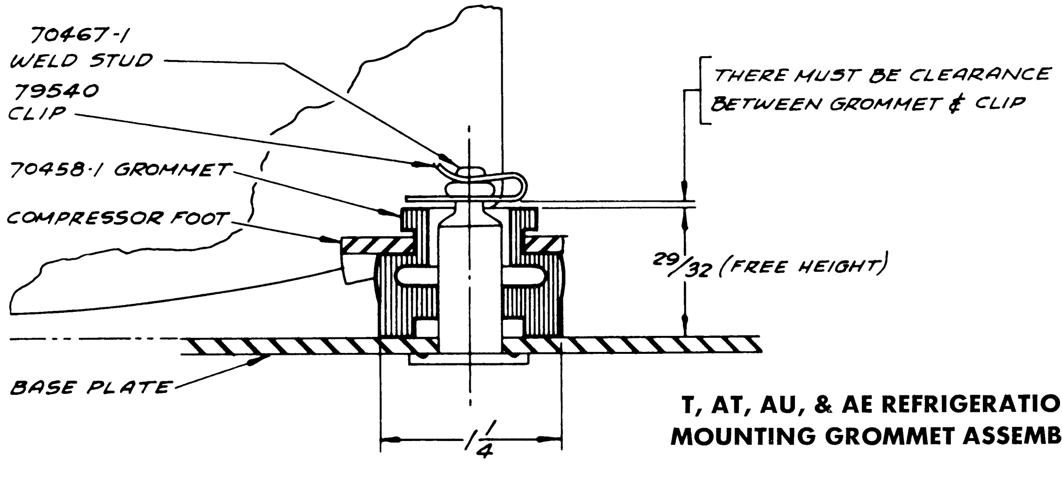
For a better understanding of the correct mounting details of Tecumseh compressors we have prepared the following cross sectional drawings applicable to most model families.



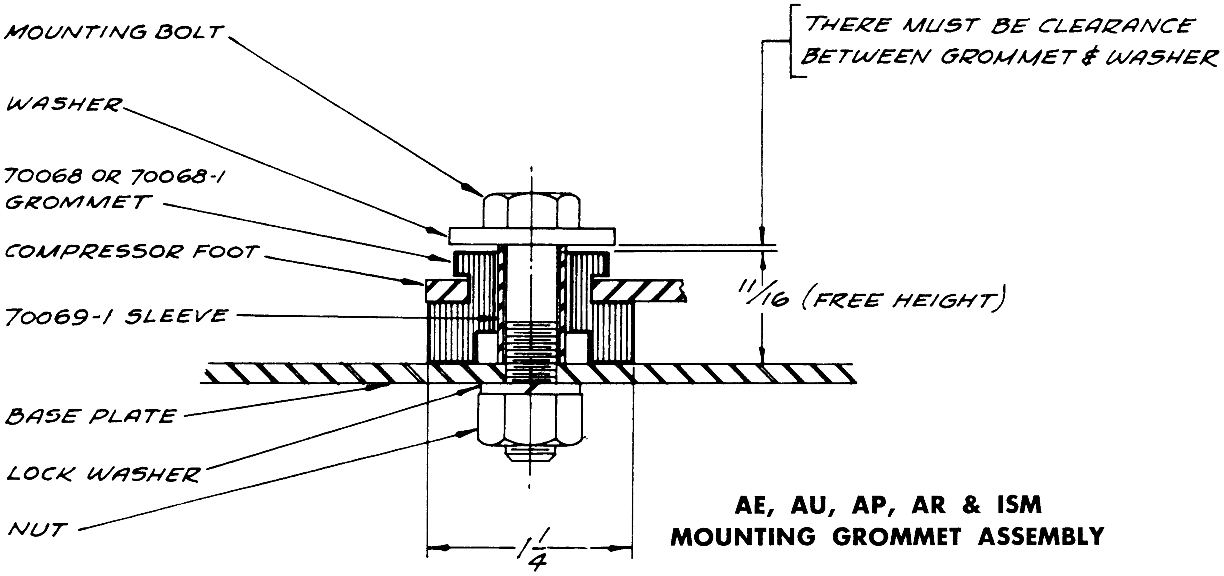
T, AT & AU MOUNTING GROMMET ASSEMBLY


70467 WELD STUD
79540 CLIP
70456-1 GROMMET
COMPRESSOR FOOT
MOUNTING RAIL OR RELIEVED BASE PLATE
THERE MUST BE CLEARANCE BETWEEN GROMMET & CLIP
11/16 (FREE HEIGHT)
1 1/4
FOR RAIL TYPE MOUNTING OR BASE PLATE WITH RELIEF HOLE OR DEPRESSION FOR BOTTOM OF COMPRESSOR.

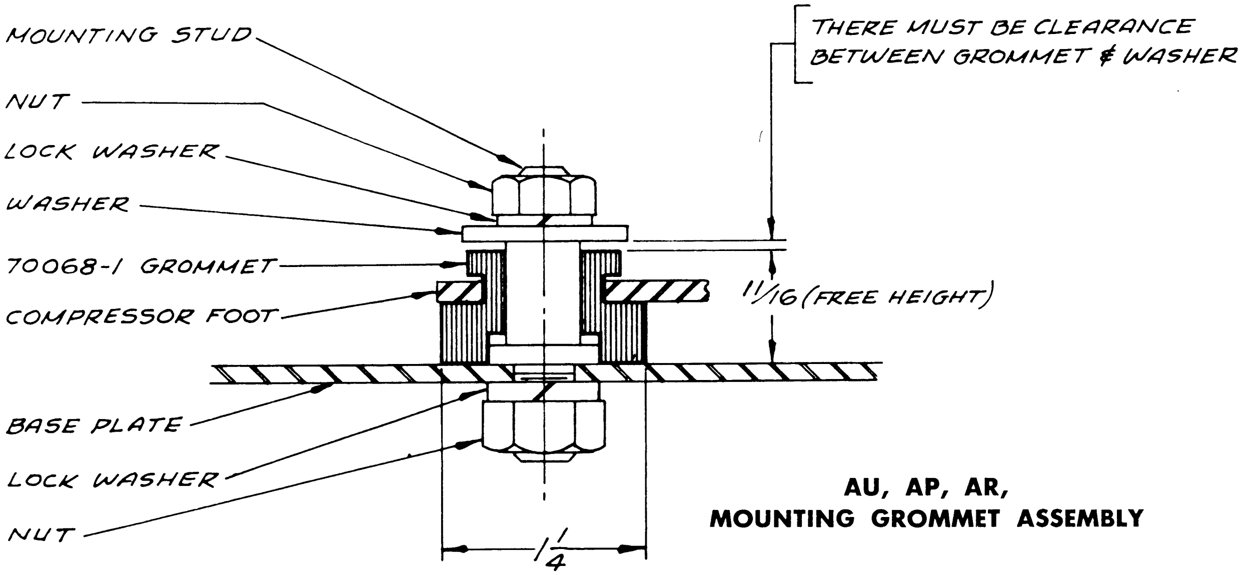
T, AT, AU & AE REFRIGERATION MOUNTING GROMMET ASSEMBLY



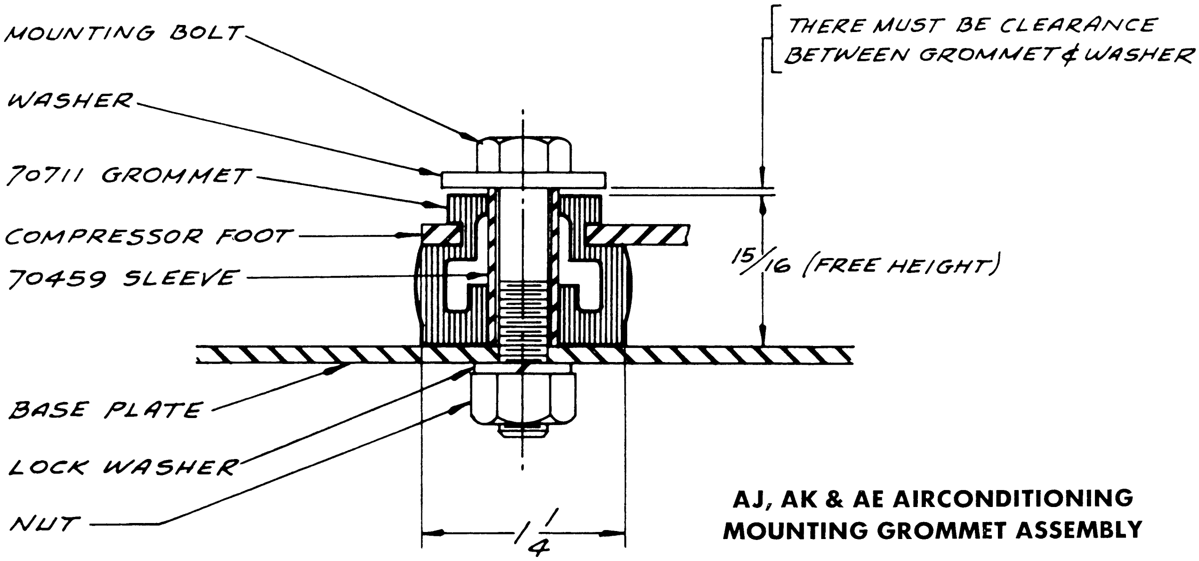
T, AT, AU, & AE REFRIGERATION MOUNTING GROMMET ASSEMBLY



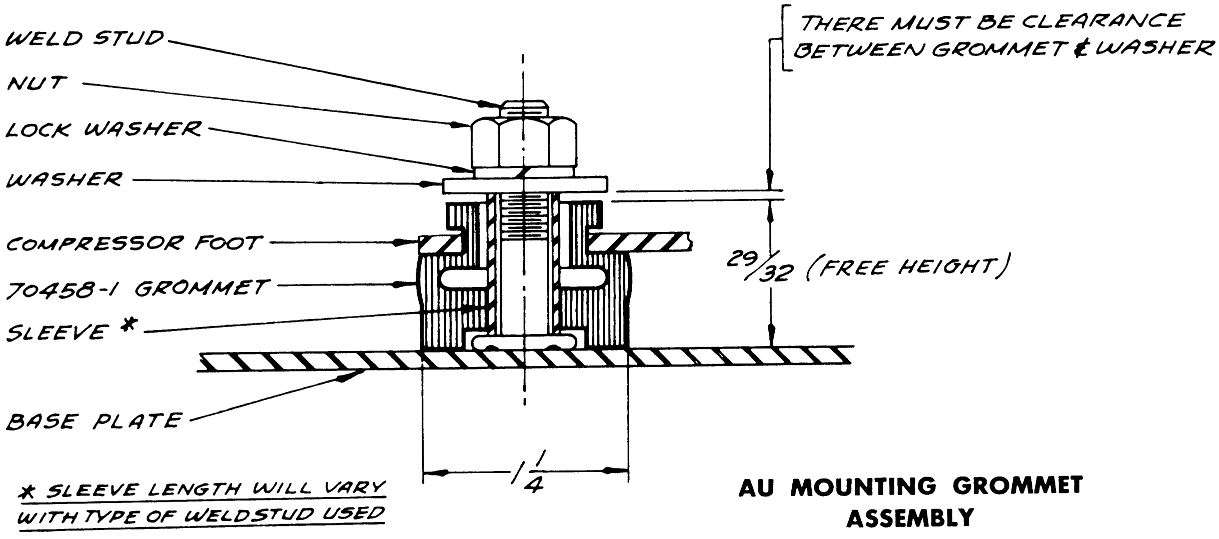
AE, AU, AP, AR & ISM MOUNTING GROMMET ASSEMBLY



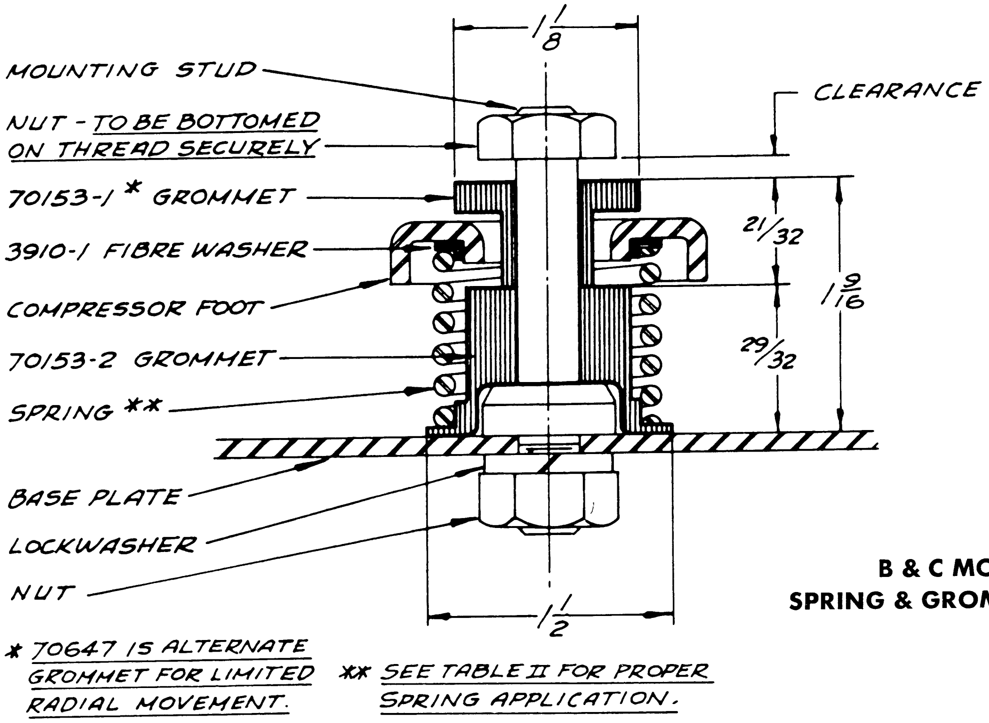
AU, AP, AR, MOUNTING GROMMET ASSEMBLY



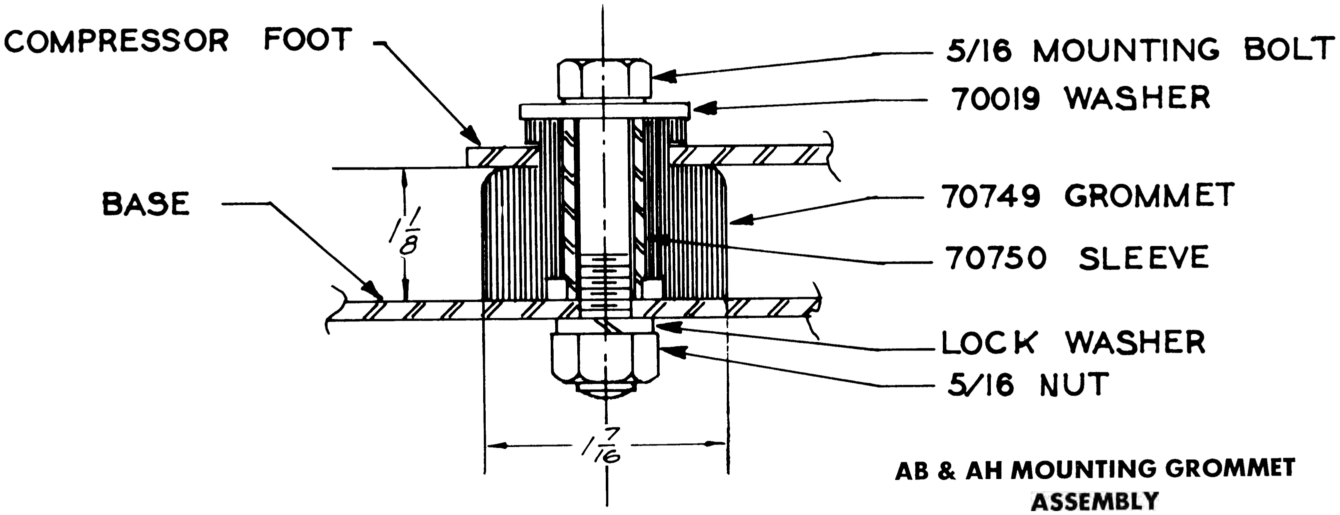
AJ, AK & AE AIRCONDITIONING MOUNTING GROMMET ASSEMBLY



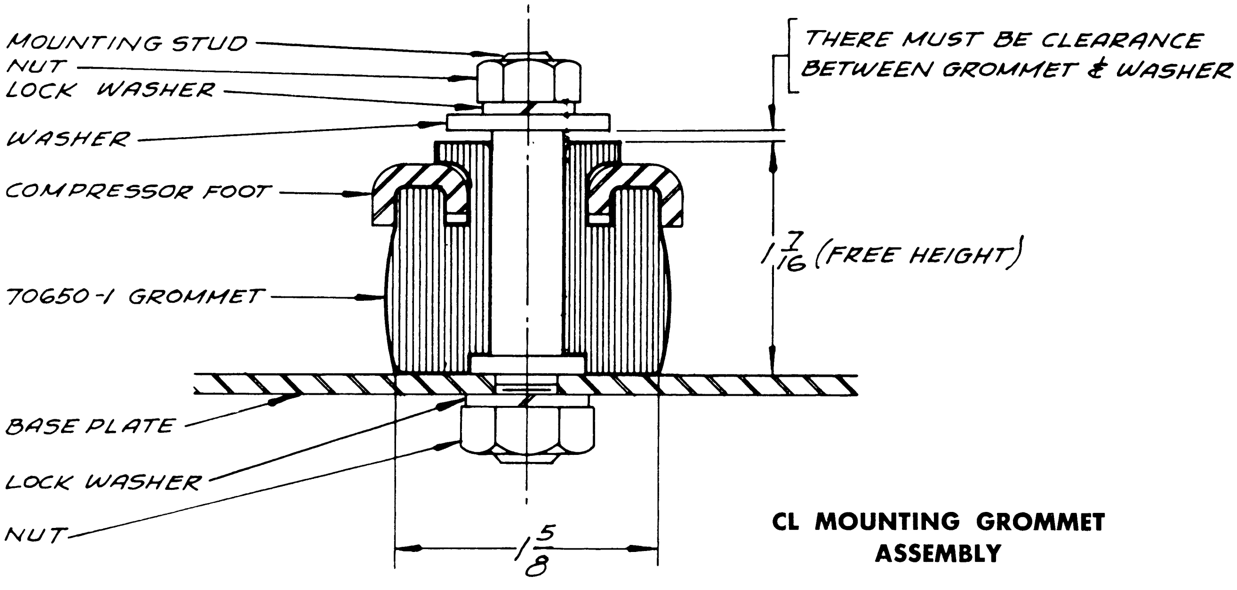
AU MOUNTING GROMMET ASSEMBLY



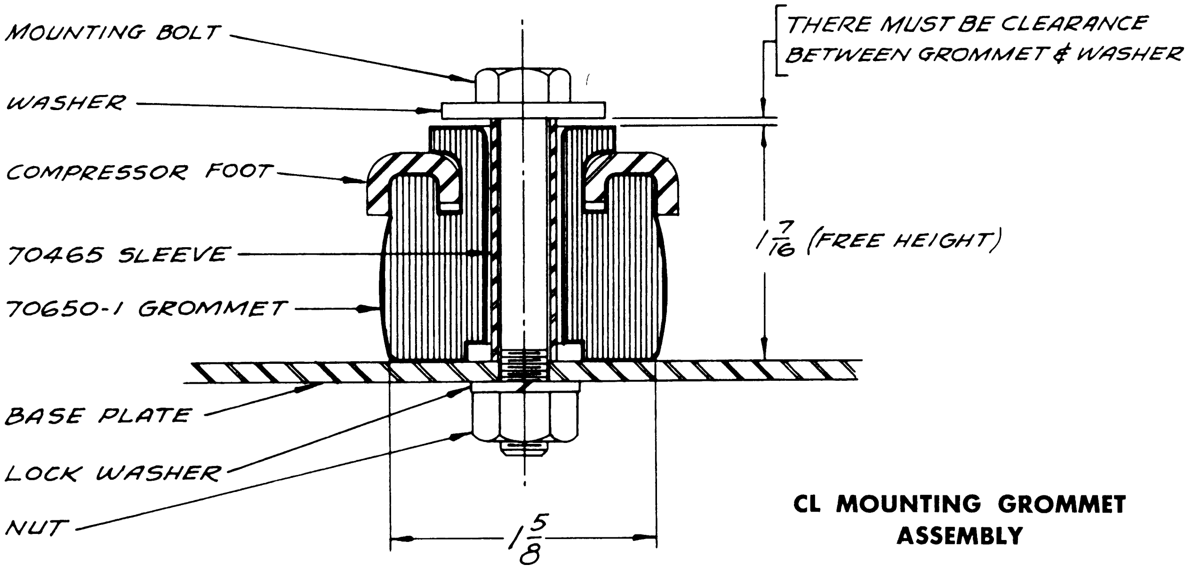
B & C MOUNTING SPRING & GROMMET ASSEMBLY



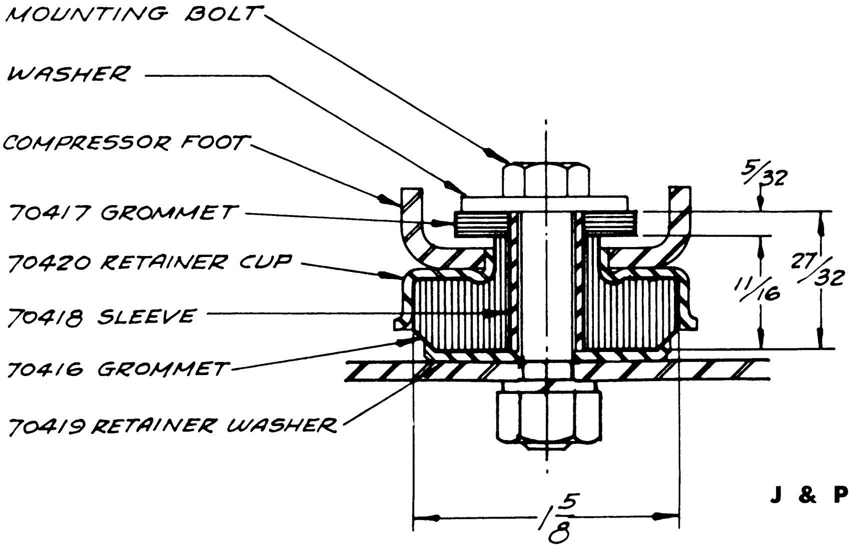
AB & AH MOUNTING GROMMET ASSEMBLY



CL MOUNTING GROMMET ASSEMBLY



CL MOUNTING GROMMET ASSEMBLY

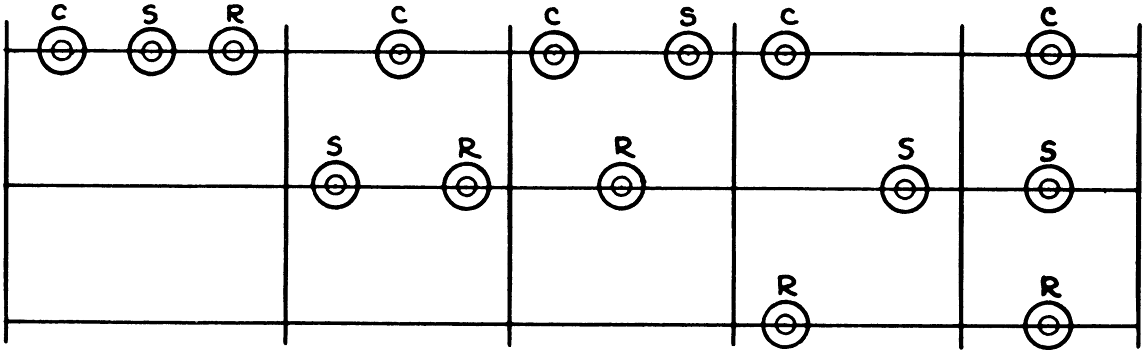


J & PJ MOUNTING GROMMET ASSEMBLY

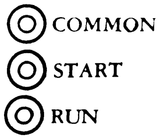
IDENTIFICATION OF COMPRESSOR TERMINALS

There are several different types of terminals used on the various models of Tecumseh compressors.

Tecumseh terminals are *always* thought of in the order: common, start, run. To "read" the terminals, we read the order exactly as we would read a book; that is, we start at the top left hand corner and read across the first "line" from left to right. When there are no more on the first line we drop down to the second line starting at the left and read across. In some cases we need three "lines" to complete our identification. Note the illustration.



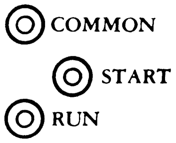
All Tecumseh compressors follow one of the above patterns with only one exception. The exception is the old twin cylinder, internal mount compressors built at Marion. These were 90° piston models designated with an "H" at the beginning of the model number (i.e. HA100). The terminals were reversed on the "H" models and read Run, Start, Common. These compressors were replaced by the "J" model series in 1955 and all "J" models follow our usual pattern of Common, Start, Run.



Built-up terminals

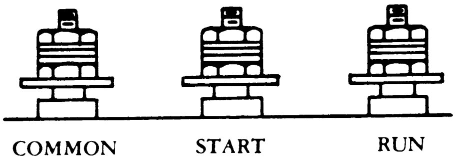
Pancake compressors.

Pancake compressors built 1953 and after have glass terminals.



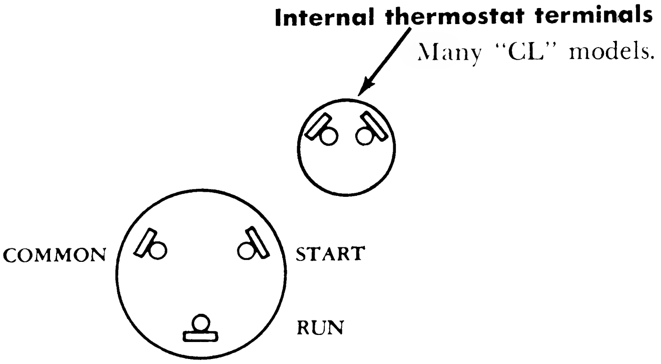
Built-up terminals

"S" and "C" single cylinder ISM (internal spring mount) models.



Built-up terminals

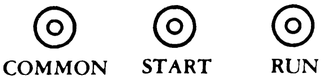
All external mount "B" and "C" twin cylinder models.
"F", "PF" and "CF" four cylinder external mount models.



Internal thermostat terminals
Many "CL" models.

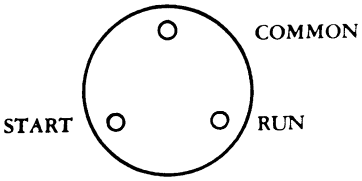
Glass quick connect terminals

"S" and "C" single cylinder ISM (internal spring mount) models.
"AK" models.
"CL" models.



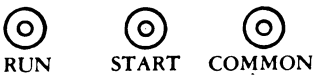
Built-up terminals

Twin cylinder internal mount "J" and "PJ" models.



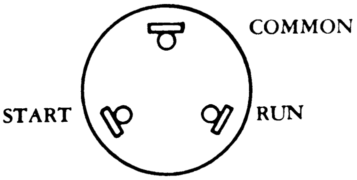
Glass terminals

Pancake type compressors (P, R, AP, AR).
"T" and "AT" models.
"AE" (refrigeration models).



Built-up terminals

Obsolete twin cylinder internal mount "H" models.



Glass quick connect terminals

"AU" and "AR26" air conditioning models.
"AE" air conditioning models.
"AB", "AJ" and "AH" models.

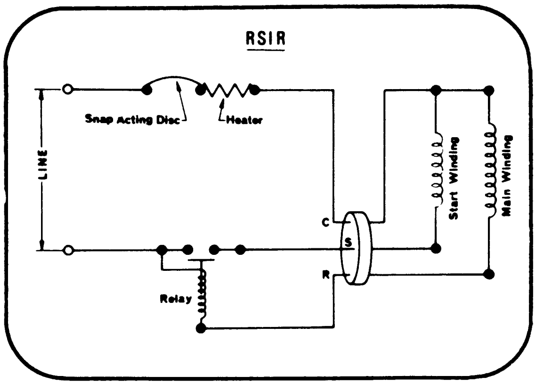
NOTE: Never attempt to solder any wire or wire termination to a compressor terminal. Heat applied to a terminal is liable to crack the glass terminal base or loosen built-up terminals causing refrigerant leakage.

Compressor Motor Types (Single Phase)

Tecumseh hermetic compressors contain motors designed for specific requirements of starting torque and running efficiency. There are four general types of single phase motors, each distinctly different from the others.

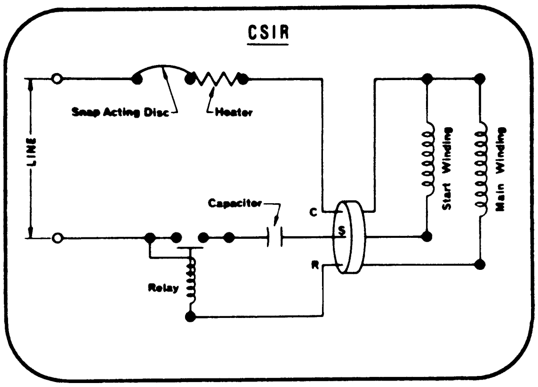
1. RSIR—Resistance Start—Induction Run

This motor is used on many small hermetic compressors up through ⅓ H.P. The motor has low starting torque and must be applied to completely self equalizing capillary tube systems such as household refrigerators, freezers, small water coolers, and dehumidifiers. This motor has a high resistance start winding which is not designed to remain in the circuit after the motor has come up to speed. A current relay is necessary to perform the function of disconnecting the start winding as the motor comes up to design speed. Select appropriate relay from Electrical Service Parts Guide Book.



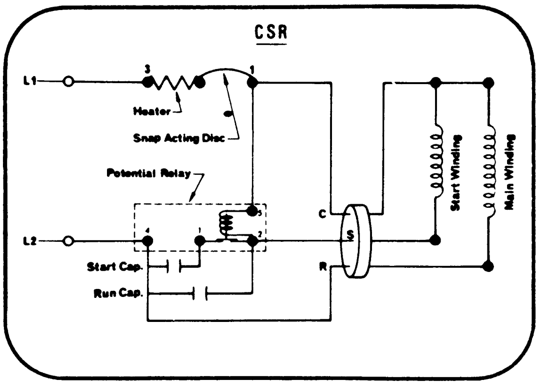
2. CSIR—Capacitor Start—Induction Run

Similar to RSIR except a start capacitor is included in series with start winding to produce a higher starting torque. This motor is commonly used on commercial refrigeration systems through ¾ H.P.



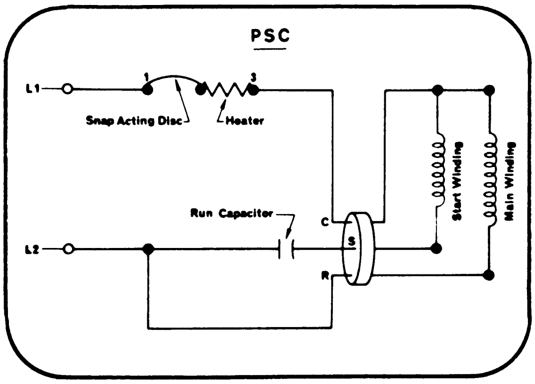
3. CSR—Capacitor Start and Run

This motor arrangement uses a start capacitor and a run capacitor in parallel with each other and in series with the motor start winding. This motor has high starting torque, runs efficiently, and is used on many refrigeration and air conditioning applications through 5 H.P. A potential relay removes the start capacitor from the circuit after the motor is up to speed. Potential relays must be accurately matched to the compressor—refer to Electrical Service Parts Guide Book for exact relay selection.



4. PSC—Permanent Split Capacitor

Here a run capacitor is in series with the start winding. Both run capacitor and start winding remain in the circuit during start and after motor is up to speed. Motor torque is sufficient for capillary and other self equalizing systems. No start capacitor or relay is necessary. PSC motors are basically air conditioning compressor motors—very common up through 3 H.P. and increasing in popularity in 4 and 5 H.P. sizes.



Compressor Locked Rotor Amps and Rating Point Amperage Draw

Listed below are Tecumseh compressors available from Tecumseh Authorized Wholesalers.

Amperage values of compressors not listed here but installed in original equipment end products, must be obtained from equipment name plate or directly from the manufacturer.

*See Page 23 for description.

Approximate Current Draw at BTU Rating Point

Model	Voltage	Bill of Material	Refrig.	Appl.	Amps	LRA	Motor Type*
AE1336A	1-115	AE120AT	12	LBP	1.7	14.6	RS1R
AE1343A	1-115	AE130AT	12	LBP	2.3	18.0	RS1R
AE1360A	1-115	AE140AT	12	LBP	2.5	22.0	RS1R
AE1380A	1-115	AE150AT	12	LBP	3.1	25.2	RS1R
AE1411E	1-115	AE210AT	22	LBP	4.5	31.0	RS1R
AE1415E	1-115	AE230AT	22	LBP	5.2	39.0	RS1R
AE3414A	1-115	AE121AT	12	HBP	2.9	18.0	RS1R
AE3417A	1-115	AE160AT	12	HBP	3.4	22.0	RS1R
AE3425A	1-115	AE170AT	12	HBP	4.4	24.0	RS1R
AE4430A	1-115	AE151BT	12	HBP	5.0	29.0	CS1R
AE4440A	1-115	AE234AT	12	HBP	6.8	32.7	CS1R
AE5460E	1-115	AE230BT	22	AC	7.0	31.0	PSC
AE5470E	1-115	AE240AT	22	AC	8.3	38.0	PSC
AK5483E	1-115	AK130AT	22	AC	9.0	43.0	PSC
AK5483E	1-230/208	AK130ET	22	AC	4.4	21.3	PSC
AK5510E	1-115	AK100AT	22	AC	10.5	47.0	PSC
AK5510E	1-230/208	AK100ET	22	AC	5.7	28.0	PSC
AK5511E	1-115	AK110AT	22	AC	11.0	50.0	PSC
AK5512E	1-230/208	AK111ET	22	AC	6.8	34.0	PSC
CAT43	1-115	8948	12	LBP	4.5	27.0	CS1R
AT35	1-115	8137	12	LBP	5.1	35.0	RS1R
CAT3J12	1-115	8637	12	LBP	5.9	43.0	CS1R
CAT4C	1-115	8943	12	HBP	6.1	27.0	CS1R
CAT34	1-115	8237	12	HBP	7.2	32.5	CS1R
AJ2425A	1-115	AJ601AT	12	LBP	7.9	57.0	CS1R
AJ2425A	1-230/208	AJ601FT	12	LBP	4.3	30.0	CS1R
AJ4443A	1-115	AJ330AT	12	HBP	6.5	35.0	CS1R
AJ4461A	1-115	AJ311AT	12	HBP	9.1	47.0	CS1R
AJ4461A	1-230/208	AJ311FT	12	HBP	4.5	24.0	CS1R
AJ4492A	1-115	AJ100AT	12	HBP	13.7	69.0	CS1R
AJ4492A	1-230	AJ100FT	12	HBP	6.9	35.0	CS1R
AJ4492A	1-230/208	AJ100GT	12	HBP	7.0	41.8	CS1R
AJ4512A	1-230	AJ131FT	12	HBP	7.3	40.0	CSR
AJ4512A	1-230/208	AJ131GT	12	HBP	7.0	41.0	CSR
AJ5515E	1-230/208	AJ110FT	22	AC	8.3	45.0	PSC
AJ5517E	1-230/208	AJ210FT	22	AC	11.0	55.0	PSC
AJ5519G	1-230/208	AJ222FT	22	AC	12.0	57.0	PSC
AJ7441A	1-115	AJ530AT	12	MBP	8.8	49.5	CS1R
AJ7441A	1-230/208	AJ530FT	12	MBP	5.0	29.0	CS1R
AJ7465A	1-115	AJ201AT	12	MBP	11.6	68.0	CSR
AJ7465B	1-230/208	AJ201GT	12	MBP	7.0	46.0	CS1R
AH2435A	1-230/208	AH400ET	12	LBP	6.4	45.0	CS1R
AH2445A	1-230/208	AH410ET	12	LBP	8.2	51.0	CS1R
AH2445A	3-240/208	AH410RT	12	LBP	3.7	34.0	3φ
AH2466A	1-230/208	AH500ET	12	LBP	9.0	71.0	CSR

Approximate Current Draw at BTU Rating Point

Model	Voltage	Bill of Material	Refrig.	Appl.	Amps	LRA	Motor Type*
AH2466A	3-240/208	AH500RT	12	LBP	5.0	47.0	3φ
AH2490AT	1-230/208	4024-1 (Dual)	12	LBP	(2) @ 8.2	(2) @51.0	CSR
AH2490AT	3-240/208	4025-2 (Dual)	12	LBP	(2) @ 3.7	(2) @34.0	3φ
AH2513AT	1-230/208	4023-2 (Dual)	12	LBP	(2) @ 9.0	(2) @71.0	CSR
AH2513AT	3-240/208	4026-2 (Dual)	12	LBP	(2) @ 5.0	(2) @47.0	3φ
AH4550AT	1-230/208	4021-1 (Dual)	12	HBP	(2) @13.8	(2) @71.0	CSR
AH4550AT	3-240/208	4022-1 (Dual)	12	HBP	(2) @ 9.2	(2) @49.0	3φ
AH4518A	1-230/208	AH110FT	12	HBP	10.0	45.0	CSR
AH4518A	3-240/208	AH200RT	12	HBP	5.8	34.0	3φ
AH4525A	1-230/208	AH300FT	12	HBP	13.8	71.0	CSR
AH4525A	3-240/208	AH303RT	12	HBP	9.2	49.0	3φ
AH5519E	1-230/208	AH131KT	22	AC	11.5	50.0	PSC
AH5524E	1-230/208	AH141FT	22	AC	12.2	60.0	PSC
AH5524E	3-240/208	AH231RT	22	AC	8.0	49.0	3φ
AH5527E	1-230/208	AH101FT	22	AC	14.4	71.0	PSC
AH5531E	1-230/208	AH152HT	22	AC	16.5	76.0	PSC
AH5531E	3-240/208	AH251RT	22	AC	9.7	65.0	3φ
AH5540E	1-230/208	AH301FT	22	AC	22.5	103.0	PSC
AH5540E	3-240/208	AH302RT	22	AC	12.5	72.0	3φ
AH5540E	3-480/440	AH302TT	22	AC	6.2	35.0	3φ
AH7480A	1-230/208	AH160FT	12	MBP	6.5	41.0	CSR
AH7480A	3-240/208	AH160RT	12	MBP	4.2	34.0	3φ
AH7511A	1-230/208	AH311FT	12	MBP	9.0	41.0	CSR
AH7511A	3-240/208	AH311RT	12	MBP	5.4	34.0	3φ
AH7511B	1-230/208	AH311GT	12	MBP	8.6	45.0	CSR
AH7514A	1-230/208	AH333ET	12	MBP	10.0	60.0	CSR
AH7514A	3-240/208	AH333RT	12	MBP	7.0	49.0	3φ
CL4532A	1-230/208	CL111FT	12	HBP	21.9	92.5	CSR
CL4532A	3-240/208	CL111RT	12	HBP	13.8	66.0	3φ
CL5544F	1-230/208	CL145ET	22	AC	23.0	115.0	PSC
CL5544G	3-240/208	CL145RT	22	AC	13.0	87.0	3φ
CL5550G	1-230/208	CL157ET	22	AC	27.0	140.0	PSC
CL5550G	3-240/208	CL157RT	22	AC	15.0	104.0	3φ
CL5550G	3-480/440	CL157TT	22	AC	9.0	50.0	3φ
CL5562G	1-230/208	CL169ET	22	AC	36.0	175.0	PSC
CL5562G	3-240/208	CL168RT	22	AC	20.0	132.0	3φ
CL5562G	3-480/440	CL168TT	22	AC	10.5	62.0	3φ
CL4564AT	1-230/208	4016-1 (Dual)	12	HBP	(2) @21.9	(2) @92.5	CSR
CL4564AT	3-240/208	4017-1 (Dual)	12	HBP	(2) @13.8	(2) @66.0	3φ

Listing of Approved Electric Contactors

for use with hermetic compressors having pilot circuit (internal thermostat) motor protection systems.

Inadequate and/or improperly rated electric contactors are frequently the direct cause of hermetic compressor motor failures.

In order to establish proper and acceptable standards for contactors approved for use with internal thermostat protected Tecumseh hermetic compressors, a qualifying specification, Tecumseh #H-76, has been made available to all contactor manufacturers.

The following list contains contactors approved to date:

Company	Type	FLA Rating	LRA Rating	Voltage Rating
Allen Bradley	775-CO3A1	30/15	180/90	240/600
Arrow-Hart & Hegeman	B-32000 Series	25/12.5	125/62.5	240/550
Arrow-Hart & Hegeman	B-32000 Series	30/15	180/90	240/550
Arrow-Hart & Hegeman	B-32000 Series	40/20	200/100	240/550
Arrow-Hart & Hegeman	DPC-34000 Series	30/15	180/90	240/550
Arrow-Hart & Hegeman	DPC-34000 Series	40/20	200/100	240/550
Arrow-Hart & Hegeman	ACC	25/20/20	150/100/100	240/480/600
Arrow-Hart & Hegeman	ACC	30/24/24	180/120/100	240/480/600
Arrow-Hart & Hegeman	ACC	40/32/32	240/160/160	240/480/600
Cutler-Hammer	9560	25/23/20	150/115/105	277/480/600
Cutler-Hammer	9560	30/23/20	180/115/105	277/480/600
Cutler-Hammer	9560	40/30/25	240/160/140	277/480/600
Elmwood Sensors, Inc.	30A	18/10/10	90/50/50	240/480/600
Elmwood Sensors, Inc.	30B	20/16/14	120/80/80	240/480/600
Elmwood Sensors, Inc.	30C	25/20/17	150/100/100	240/480/600
Elmwood Sensors, Inc.	30D	25/25/20	150/125/100	240/480/600
Elmwood Sensors, Inc.	30E	30/30/24	180/150/120	240/480/600
Elmwood Sensors, Inc.	30F	40/30/24	240/150/120	240/480/600
Elmwood Sensors, Inc.	30CD	30/20/17	150/100/100	240/480/600
Furnas	41NA Series	25/12.5	150/75	240/550
Furnas	41NB Series	25/12.5	150/75	240/550
Furnas	41CB Series	20/10	100/50	240/550
Furnas	41DB Series	30/15	150/75	240/550
Furnas	41EB Series	40/20	200/100	240/550
Furnas	42BC Series	20/10	100/50	240/550
Furnas	42CC Series	30/15	150/75	240/550
Furnas	42DC Series	40/20	200/100	240/550
Furnas	42BD Series	30/30/30	180/150/150	240/480/600
Furnas	42CD Series	40/40/40	240/200/200	240/480/600
Furnas	42BE Series	30/30/30	180/150/120	240/480/600
Furnas	42CE Series	40/40/40	240/200/160	240/480/600
General Controls	R-5	30/15	150/75	250/480
General Controls	R-6	20	100	250
General Controls	R-9	25/15	125/75	250/480
General Controls	R-10	40/20	200/100	250/480
General Electric	3ARR8	25	125	240
General Electric	CR153A, 154A	20/20/16	120/100/80	240/480/600
General Electric	CR153B, 154B	25/25/20	150/120/100	240/480/600
General Electric	CR153C, 154C	30/30/24	180/150/120	240/480/600
General Electric	CR153D, 154D	40/32.5/24	240/160/120	240/480/600
General Electric	CR153DA	40/40/32.5	240/200/160	240/480/600
Honeywell, Inc.	R850	18/10/10	90/50/50	240/480/600
Honeywell, Inc.	R850	25/15/12.5	125/75/62.5	240/480/600
Honeywell, Inc.	R850	20/12/12	100/60/50	240/480/600
Honeywell, Inc.	R8172	30/15/10	150/75/50	240/480/550
Honeywell, Inc.	R8172	40/20/15	200/100/75	240/480/550

Listing of Approved Contactors per Tecumseh Products Co. Spec. H-76

Company	Type	FLA Rating	LRA Rating	Voltage Rating
Honeywell, Inc.	R843	25	125	240
Honeywell, Inc.	R8210	25/25/20	150/125/105	240/480/600
Honeywell, Inc.	R8212	30/30/24	180/150/120	240/480/600
Honeywell, Inc.	R8214	40/30/30	240/160/160	240/480/600
Honeywell, Inc.	R4220 & R8220	50/50/40	300/250/200	277/480/600
RBM Controls	80 (2 pole)	25	150	250
RBM Controls	80 (1 pole)	25	125	250
RBM Controls	85	25/12.5	150/75	250/600
RBM Controls	S 30	30/15	180/90	250/600
RBM Controls	S 40	40/20	200/100	250/600
RBM Controls	C 30	30/25/18	180/150/90	240/480/600
RBM Controls	C 40	40/25/18	200/150/90	240/480/600
RBM Controls	143-1	18/10/10	90/50/50	277/480/600
RBM Controls	143-2	20/17/14	120/100/80	277/480/600
RBM Controls	143-6	25/21/17	150/125/100	277/480/600
RBM Controls	154-1	20/20/16	120/100/80	277/480/600
RBM Controls	154-2	25/25/20	150/125/100	277/480/600
RBM Controls	154-3	30/30/24	180/150/120	277/480/600
RBM Controls	154-4	40/40/32	240/200/160	277/480/600
Rowan Controller, Inc.	EB & EBC-230 Ser.	25/25/20	150/125/100	277/480/600
Rowan Controller, Inc.	EB & EBC-330 Ser.	30/30/24	180/150/120	277/480/600
Rowan Controller, Inc.	EB & EBC-430 Ser.	40/40/30	240/200/160	277/480/600
Rowan Controller, Inc.	2210DP-H Ser.	20/20/16	120/100/80	240/480/600
Rowan Controller, Inc.	2110DP-J Ser.	25/20/18	125/105/90	240/480/600
A. O. Smith	7735DP	25/24/20	150/120/105	240/480/600
A. O. Smith	7735DP	30/24/20	180/120/105	240/480/600
A. O. Smith	7735DP	40/32.5/28	240/160/140	240/480/600
White-Rodgers	895-1	25	150	240
White-Rodgers	898-1	20	120	240
White-Rodgers	899-1	18	108	240

The Tecumseh Products Company reserves the right to void its hermetic compressor warranty if contactors used are not capable of passing the tests and stipulations included in Specification #H-76.

Fuse Sizing

Compressor Motor—Branch Circuit, Short Circuit, and Ground Fault Protection Only.

Maximum Size

The maximum size of the fuse used to protect against short circuit and/or ground fault of a motor-branch-circuit which supplies power to a unit utilizing a hermetic compressor shall be no more than the sum of 225% of the compressor motor F.L.A. as marked on the unit nameplate, plus the F.L.A. values of each of the other motors which use the same branch circuit.

Minimum Size:

The minimum value of the fuse shall be no less than 175% of the F.L.A. of the compressor.

The interpretations and directions given above apply only to single branch power supplies, and do NOT pertain to any plug-in type of appliances.

Electrical Transformer Selection

It is sometimes necessary to use a transformer to step up or step down the available supply voltage.

For example – Available power is 208 v., 60 cycle
Compressor model is 230 v., 60 cycle

Transformers are rated by VA or KVA

VA Volt amps
KVA 1000 volt amps

Formula to provide transformer of minimum KVA:

Minimum KVA =

$$\frac{(\text{Unit FLA}) \times (\text{Compressor Nominal Volts}) \times (1.3)}{1000}$$

If unit FLA (full load amps) is not known, then use compressor FLA.

Example: Unit nameplate FLA is 15 amps
Compressor nameplate voltage is 230
$15 \times 230 \times 130\% \div 1000 = 4.48$

If this minimum KVA 4.48 is not equal to the rating of a standard transformer, then select a transformer of the next higher rating. In this case probably a 5 KVA transformer.

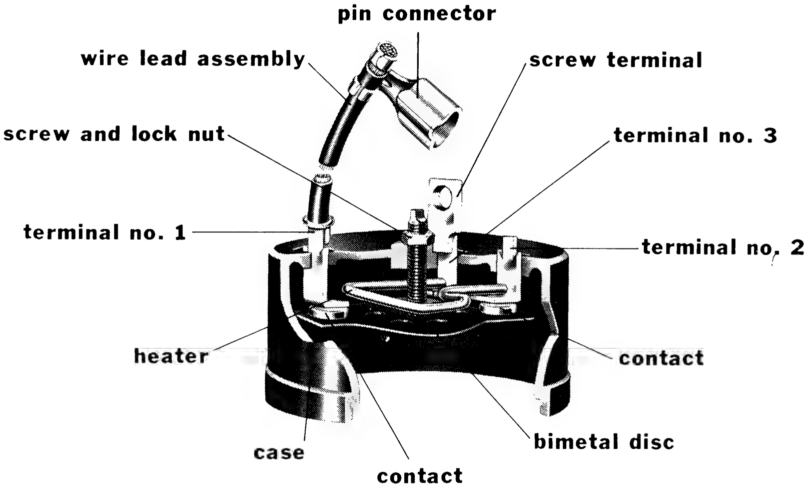
HERMETIC COMPRESSOR MOTOR COMPONENTS

Overloads

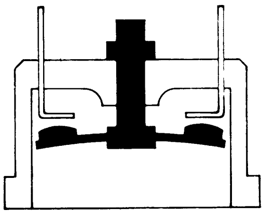
Hermetic compressor motors are protected from overheating by devices built into, or mounted in contact with the compressor. Refer to Electrical Service Parts Guide Book for correct replacement overloads.

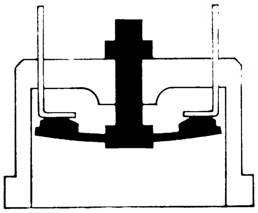
External Line Break Overload

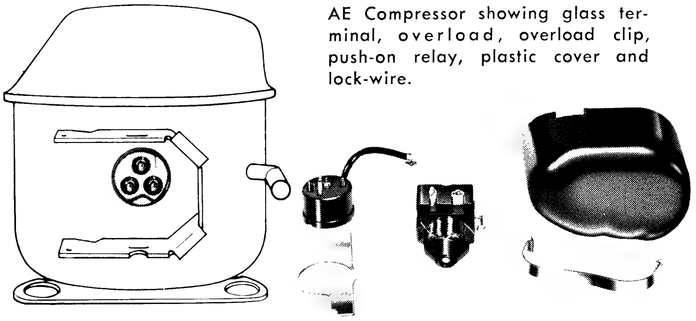
Models AE, T, AT, CAT, P, AP, CAP, AR, S, AK, B, C, AJ, CAJ, AU, J, PJ, F, PF, CF, and some CL.

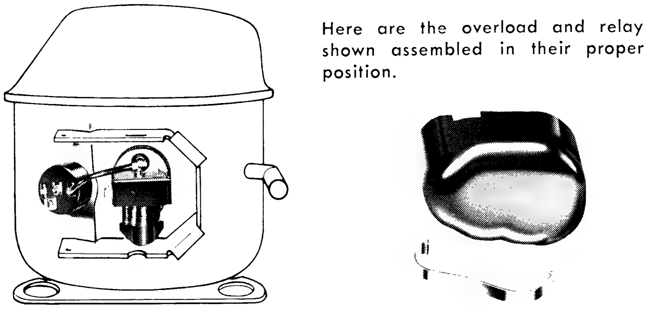


This motor overload device, firmly attached to the compressor housing, quickly senses any unusual temperature rise or excess current draw. The bi-metal disc reacting to either excess temp. and/or excess current draw, flexes downward thereby disconnecting compressor from power source.


OPEN


CLOSED

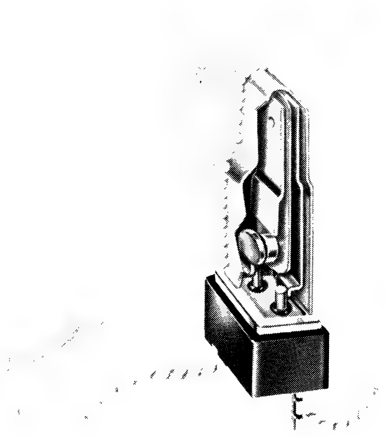

AE Compressor showing glass terminal, overload, overload clip, push-on relay, plastic cover and lock-wire.


Here are the overload and relay shown assembled in their proper position.

Typical Wiring Diagrams are shown on Pages 37 to 46.

Internal Line Break Overload

Models AB, AH and some CL.



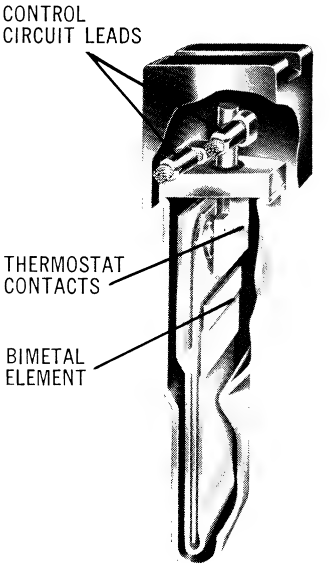
INTERNAL (LINE-BREAK) MOTOR PROTECTOR

INTERNAL LINE BREAK OVERLOAD
COMPLETELY INTERNAL
TAMPER-PROOF
CANNOT BE BY-PASSED

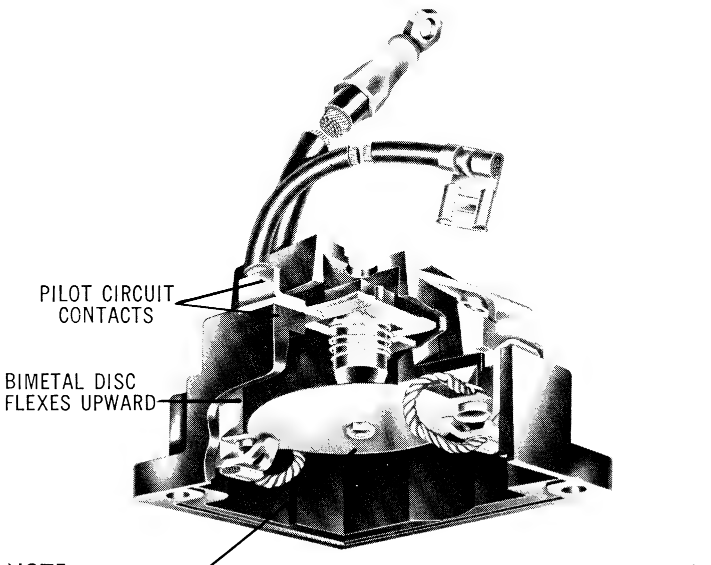
Located precisely in the center of "heat sink" portion of motor windings this device detects excessive motor winding temperature and safely protects compressor from excessive heat and/or current draw.

Internal Pilot Circuit Thermostat and Supplementary Overload

Some CL Models.



INTERNAL THERMOSTAT EMBEDDED IN MOTOR WINDING



NOTE:
BIMETAL DISC DOES NOT BREAK LINE CURRENT

EXTERNAL (PILOT DUTY) OVERLOAD SENSING MOTOR CURRENT

External hermetic terminals of motor winding thermostat (See page 22 for identification) must be wired in series with the contactor holding coil and the pilot circuit contacts of the external supplementary current sensitive overloads.

If the motor temperature rises above safe limits, the thermostat opens the holding coil circuit. The contactor then disconnects the compressor from power source.

Supplementary overloads as shown *do not break line current* but instead interrupt current flow to the contactor holding coil. The contactor then disconnects the compressor from power source.

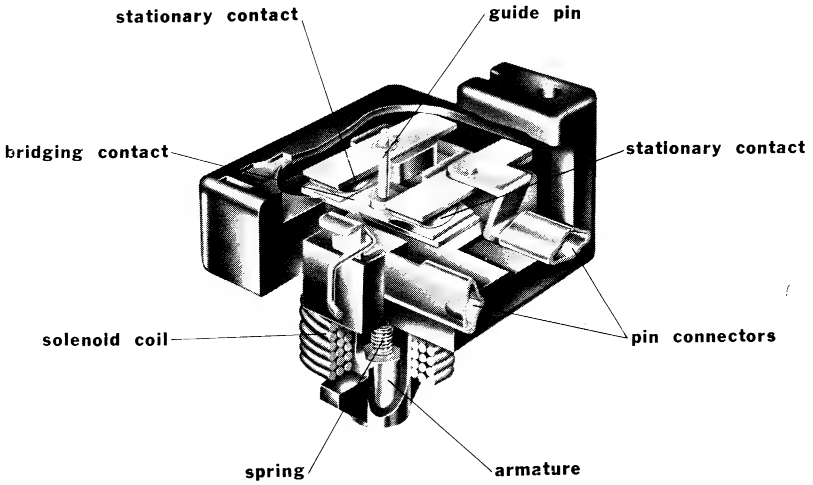
Compressor Motor Relays

A hermetic compressor motor relay is an automatic switching device designed to disconnect the motor start winding after motor has attained running speed.

There are two types of motor relays used in refrigeration and air conditioning compressor applications.

Relay — Current Type

Generally used with small refrigeration compressors up to 3/4 H.P.



RELAY-CURRENT TYPE

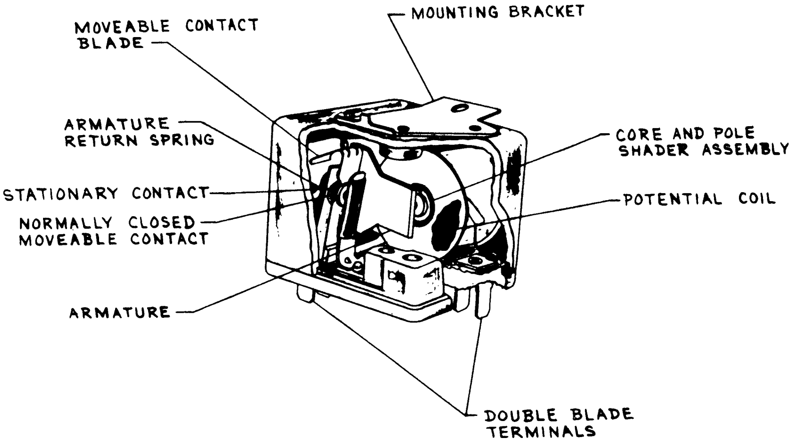
When power is applied to compressor motor, the relay solenoid coil attracts relay armature upward causing bridging contact and stationary contact to engage. This energizes motor start winding. When compressor motor attains running speed the motor main winding current is such that the relay solenoid coil de-energizes allowing the relay contacts to drop open thereby disconnecting motor start winding.

NOTE: Relay must be mounted in true vertical position so armature and bridging contact will drop free when relay solenoid is de-energized.

Relay — Potential Type

Generally used with large commercial and air conditioning compressors (capacitor start, capacitor run) to 5 H.P. Relay contacts are normally closed. The relay coil is wired across the start winding, and senses voltage change. Start winding voltage increases with motor speed. As the voltage increases to the specific pickup value, the armature pulls up, opening the relay contacts, de-energizing the start winding. After switching there is still sufficient voltage induced in the start winding to keep the relay coil energized and the relay starting contacts open. When power is shut off to the motor, the voltage drops to zero, the coil is de-energized, and the start contacts reset.

NOTE: Many relays are extremely position sensitive. When changing a compressor relay, care should be taken to install replacement in the same position as the original. Never select a replacement relay solely by horsepower or other generalized rating. Select the correct relay from the Tecumseh Electrical Service Parts Guide Book.



Tecumseh Compressor Motor Resistance Values

Approximate range of resistance in ohms of the motor winding at room temperature (77°F).

"Both" winding resistance of the combined run and start winding is measured across compressor terminals "R" and "S". See page 21 for terminal identification.

3 phase resistance is measured across any pair of terminals.

"Start" winding resistance is measured across terminals "S" and "C".

All motors are for 60 Hertz (cycle) power.

See Hermetic Compressor Motor Field Procedure Page 54.

AE Model

New Model	Old Model	Volts	Phase	Resistance Range (Ohms)	
				Start	Both
AE1320A	AE20Z5	115	1	16-20	22-26
AE1320B		115	1	52-55	59-62
AE1332A	AE12Z7	115	1	13-18	19-23
AE1332A	AE12Z7	220	1	60-63	77-80
AE1336A	AE8ZA7	115	1	14-19	19-24
AE1336A	AE8ZA7	220	1	59-62	76-79
AE1343A	AE6ZD7	115	1	10-17	14-21
AE1343A	AE6ZD7	220	1	61-64	74-77
AE1360A	AE5ZF9	115	1	11-15	13-18
AE1360A	AE5ZF9	220	1	65-68	74-77
AE1380A	AE4ZF11	115	1	11-19	13-21
AE1410A		115	1	5-9	7-10
AE1411E		115	1	12-15	14-17
AE1411E		230/208	1	38-41	42-45
AE1413A		115	1	5-8	7-10
AE1415E		115	1	15-18	16-19
AE1415E		230/208	1	67-70	71-74
AE3414A	AE6ZA7	115	1	10-17	14-21
AE3414A	AE6ZA7	220	1	61-64	74-77
AE3417A	AE5ZA9	115	1	11-15	13-17
AE3425A	AE59ZF9	115	1	11-15	13-17
AE3430A	AE41ZF11	115	1	11-15	12-17
AE3440A		115	1	10-15	12-16
AE4430A		115	1	3-7	5-8
AE4430A		230/208	1	13-16	18-21
AE4440A		115	1	5-9	7-10
AE4440A		230/208	1	23-27	29-32
AE5455E		115	1	11-15	12-16
AE5460E		115	1	10-14	11-16
AE5465E		115	1	10-14	11-15
AE5465E		230/208	1	5-8	8-11
AE5465E		277/265	1	11-14	16-19
AE5465F	(AE8475E)	115	1	9-14	10-15
AE5470E		115	1	11-14	11-15
AE8458E		115	1	12-16	14-18
AE8475E		115	1	9-14	10-15

AJ Model

New Model	Old Model	Volts	Phase	Resistance Range (Ohms)	
				Start	Both
AJ1416A	AJ3612	115	1	5-8	6-10
AJ1411E	AJ438	115	1	9-12	10-14
		230/208	1	38-46	43-52
AJ1414E	AJ3E	115	1	9-12	10-13
		230/208	1	38-45	42-49
AJ1420E	AJ26	115	1	6-9	6-10
		230/208	1	9-12	11-15
AJ2416A	CAJ3612	115	1	5-8	5-9
		230/208	1	7-10	10-14
AJ2416B	CAJ3P	115	1	5-11	6-12
		230/208	1	15-27	19-30
AJ2425A	CAJ2T12	115	1	2-5	3-6
		230/208	1	12-15	14-17
AJ4443A	CAJ34	115	1	6-9	7-10
		230/208	1	22-25	25-29
AJ4461A	CAJ2612	115	1	3-6	3-7
		230/208	1	16-19	18-22

AJ Model—continued

New Model	Old Model	Volts	Phase	Resistance Range (Ohms)	
				Start	Both
AJ4461B	CAJ2P	115	1	4-8	4-9
		230/208	1	19-23	22-26
AJ4492A	CAJ7R13	115	1	1-4	2-5
		230	1	10-13	11-15
		230/208	1	8-11	10-13
AJ4512A		230	1	5-10	7-11
		230/208	1	5-8	7-10
AJ5460E	AJ3	115	1	10-17	11-18
		230/208	1	9-15	13-20
AJ5460F	AJ68	115	1	14-18	15-19
AJ5465E	AJ2L8	115	1	9-15	10-16
AJ5470E	AJ4	115	1	10-17	11-18
		230/208	1	9-15	13-20
		208	1	11-14	14-18
AJ5471E	AJ14	115	1	7-12	7-13
		230/208	1	7-11	11-15
AJ5478E		115	1	1-4	2-5
AJ5483E	AJ16	115	1	9-15	10-16
		230/208	1	8-13	11-16
		277/265	1	10-13	13-17
AJ5494E	AJ1P	115	1	7-12	8-13
		208	1	7-12	10-14
		230/208	1	7-12	9-14
AJ5510E	AJ1612	115	1	3-10	4-10
		208	1	7-10	9-13
		230/208	1	5-10	8-13
		277/265	1	11-14	14-17
AJ5510F	AJ1Q	115	1	5-9	5-10
		208	1	8-11	10-14
		230	1	8-13	11-16
		230/208	1	8-12	10-15
		277/265	1	10-13	13-16
AJ5511E	AJ1M12	115	1	3-10	4-10
AJ5511F	AJ1R	115	1	3-7	4-8
AJ5511G	AJ1S	115	1	1-3	1-4
AJ5512A		230/208	1	8-13	10-14
AJ5512E	AJ1P12	115	1	3-6	4-7
		208	1	6-10	7-12
		230/208	1	8-13	10-14
		277/265	1	11-14	13-17
AJ5512F	AJ1T	208	1	9-14	10-16
		230	1	7-13	9-16
		230/208	1	6-12	8-15
		277/265	1	10-13	12-15
AJ5513E	AJ1P13	208	1	9-13	11-14
		230/208	1	8-13	10-14
		277/265	1	7-10	8-12
AJ5513F	AJ1R12	115	1	6-10	7-11
		208	1	7-11	8-13
		230	1	7-11	8-13
		230/208	1	6-10	8-12
		277/265	1	7-11	9-13
AJ5512G	(AJ8514E)	115	1	1-3	1-4
AJ5515E	AJR13	208	1	9-13	11-14
		230/208	1	8-13	10-14
		277/265	1	7-10	8-12
AJ5515F	AJT12	208	1	5-9	7-10
		230	1	5-9	6-11

AJ Model—continued

New Model	Old Model	Volts	Phase	Resistance Range (Ohms)	
				Start	Both
AJ5515F	AJT12	230/208	1	5-9	6-10
		277/265	1	6-9	7-11
AJ5517E	AJR15	208	1	3-7	4-8
		230/208	1	4-7	5-9
		277/208	1	4-7	5-9
AJ5518E	AJT15	208	1	3-7	4-8
		230	1	3-7	4-8
		230/208	1	4-7	5-8
		277/265	1	3-6	4-8
AJ5519E		230/208	1	4-7	5-8
		277/265	1	5-8	6-10
AJ5519G		230/208	1	4-7	5-8
AJ6435A	AJ2612	115	1	5-8	5-9
AJ7441A		115	1	1-4	2-5
		230/208	1	5-8	7-10
AJ7465A		115	1	1-4	1-5
AJ7465B		230/208	1	5-8	6-10
AJ8494E	AJ5478E	115	1	1-4	2-5
AJ8514E	AJ5512G	115	1	1-3	1-4
AJ8516E		230/208	1	5-8	7-10
AJ8520E		230/208	1	1-4	3-6

AH Model

New Model	Old Model	Volts	Phase	Resistance Range (Ohms)	
				Start	Both
AH2435A		230/208	1	1-4	3-6
		240/208	3		1-4
AH2445A		230/208	1	1-4	3-6
		240/208	3		1-4
AH2466A		230/208	1	3-6	3-6
		240/208	3		1-3
AH2511J		230	1	1-5	2-5
AH2511K		230/208	1	1-3	1-4
AH4515A		230/208	1	2-5	3-7
AH4516A	AH17Q13	230/208	1	2-5	3-7
AH4518A	AH20S13	230/208	1	2-5	3-7
		240/208	3		1-4
		480/440	3		5-8
AH4525A		230/208	1	1-5	2-6
		240/208	3		1-3
		480/440	3		5-8
AH5519E		230/208	1	4-7	5-9
AH5520E	AH20L12	208	1	3-5	3-6
		230	1	2-5	3-7
		230/208	1	2-5	3-7
		277/265	1	NA	
		240/208	3		1-3
		480/440	3		5-8
AH5522E	AH22M12	208	1	2-5	3-6
		230	1	2-5	3-7
		230/208	1	2-5	3-7
		277/265	1	2-7	4-7
		240/208	3		1-3
		480/440	3		5-8
AH5524E	AH24P12	208	1	2-5	3-6
		230	1	2-5	3-7
		230/208	1	2-5	3-6
		277/265	1	2-5	3-7
		240/208	3		1-3
		480/440	3		5-8
AH5527E	AH28Q13	208	1	2-4	3-6
		230	1	1-5	2-6
		230/208	1	1-5	2-6
		277/265	1	1-5	2-6
		240/208	3		1-3
		480/440	3		5-8
AH5530E	AH31S13	208	1	2-5	2-5

AH Model—continued

New Model	Old Model	Volts	Phase	Resistance Range (Ohms)	
				Start	Both
AH5530E	AH31S13	230	1	2-5	2-6
		230/208	1	2-5	2-6
		277/265	1	2-5	3-6
		240/208	3		1-3
		480/440	3		5-8
AH5531E		208	1	2-5	3-5
		230	1	1-5	2-6
		230/208	1	2-5	2-6
		277/265	1	2-5	3-6
		240/208	3		1-3
		480/440	3		5-8
AH5531F	AH31T13	208	1	2-5	2-5
		230	1	2-5	2-6
		230/208	1	2-5	2-5
		277/265	1	2-5	3-6
		240/208	3		1-3
		480/440	3		5-8
AH5534E	AH34X13	208	1	2-5	3-6
		230	1	1-5	2-5
		230/208	1	NA	
		277/265	1	NA	
		240/208	3		1-3
		480/440	3		5-8
AH5540E	AH40X15	208	1	1-4	2-5
		230	1	1-5	1-5
		230/208	1	1-5	1-5
		277/265	1	NA	
		240/208	3		1-3
		480/440	3		3-6
AH5540G		230/208	1	1-5	1-5
AH7480A		230/208	1	3-6	4-7
		240/208	3		1-4
AH7511A		230/208	1	3-6	4-7
		240/208	3		1-4
AH7511B		230/208	1	2-5	3-7
		240/208	3		
AH7514A		230/208	1	2-5	3-6

CL Model

New Model	Old Model	Volts	Phase	Resistance Range (Ohms)	
				Start	Both
	CL26Y14	230	1	2-5	3-6
		230/208	1	1-5	2-5
		240/208	3		1-3
		480/440	3		4-7
	CL26X12	230	1	2-5	3-6
		230/208	1	1-5	2-6
		240/208	3		1-3
		480/440	3		4-7
	CL26ZA14	230/208	1	1-5	2-5
		240/208	3		1-3
CL4532A	CL31ZC17	208	1	1-5	2-5
		240/208	3		1-3
		480/440	3		4-7
CL5538E	CL31Y14	208	1	3-6	4-7
		230	1	2-5	3-6
		230/208	1	1-5	2-5
		240/208	3		1-3
		480/440	3		4-7
		600/550	3		8-11
CL5538F		230/208	1	1-5	2-5
CL5538G		240/208	3		1-3
		480/440	3		4-7
CL5540E	CL32ZA14	230	1	1-5	2-5
		230/208	1	1-5	2-5
		240/208	3		1-3

CL Model—continued

New Model	Old Model	Volts	Phase	Resistance Range (Ohms)	
				Start	Both
CL5540E	CL32ZA14	480/440	3		4-7
		600/550	3		8-11
CL5540F		230	1	1-5	2-5
CL5540G		240/208	3		1-3
		480/440	3		4-7
CL5544E	CL36ZC14	230/208	1	1-4	1-4
		240/208	3		1-3
		480/440	3		2-5
		600/550	3		4-7
CL5544F		230/208	1	1-4	1-4
CL5544H		230/208	1	1-4	1-4
CL5544G		240/208	3		1-3
		480/440	3		2-5
CL5550E	CL41ZA17	230/208	1	1-4	1-4
		240/208	3		1-3
		480/440	3		1-5
		600/550	3		4-7
CL5550G		230/208	1	1-4	1-4
		240/208	3		1-3
		480/440	3		1-5
CL5562E	CL51ZH17	230	1	1-3	1-3
		230/208	1	1-3	1-3
		240/208	3		1-3
		480/440	3		1-4
		600/550	3		2-5
CL5562F		230/208	1	1-3	1-3
		240/208	3		1-3
CL5562G		230	1	1-3	1-3
		230/208	1	1-3	1-3
		240/208	3		1-3
		480/440	3		1-4

AM Model

Model	Volts	Phase	Resistance Range (Ohms)	
			Start	Both
AM12Z7	115	1	13-16	18-22
AM8ZA7	115	1	19-22	24-27
AM6ZA7	115	1	12-15	16-19
AM6ZD7	115	1	19-22	24-27

J & PJ Models

Model	Volts	Phase	Resistance Range (Ohms)	
			Start	Both
JA75	115	1	1-4	2-5
	230	1	11-14	14-17
JA100	230	1	6-9	7-10
JB100	208	1	6-9	7-10
	230	1	6-9	7-10
JA150	230	1	3-6	4-7
	220/208	3		1-4
JB150	230	1	3-6	4-7
	220/208	3		1-4
JE150	230	1	3-6	4-7
	220/208	3		1-4
JG150	230	1	3-6	4-7
	220/208	3		1-4
JB200	230	1	1-5	2-6
	220/208	3		1-3
JE200	230	1	1-5	2-6
	220/208	3		1-3
JG200	230	1	1-5	2-6
	220/208	3		1-3
JE300	230	1	1-4	1-4
	220/208	3		1-3
JE301	230	1	1-3	1-4
	220/208	3		1-4

J & PJ Models—continued

Model	Volts	Phase	Resistance Range (Ohms)	
			Start	Both
PJE300	230	1	1-3	1-4
	220/208	3		1-3
PJE301	230	1	1-3	1-4
	220/208	3		1-3
PJG300	230	1	1-3	1-3
	220/208	3		1-3
PJG301	230	1	1-3	1-3
	220/208	3		1-3

F and PF Models

Model	Volts	Phase	Resistance Range (Ohms)	
			Start	Both
FD200	230	1	1-4	2-5
	220/208	3		1-3
FB300	230	1	1-4	1-4
	220/208	3		1-3
FE300	230	1	1-4	1-4
	220/208	3		1-3
FE400	230	1	1-3	1-3
	220/208	3		1-3
CFB400	230	1	1-3	1-3
	220/208	3		1-3
PFB400	230	1	1-3	1-3
	220/208	3		1-3
	440	3		1-4
PFB403	230	1	1-3	1-3
	220/208	3		1-3
	240/208	3		1-3
	440	3		1-4
	550	3		2-5
FB500	230	1	1-3	1-4
	220/208	3		1-3
	440	3		1-4
FB503	230	1	1-3	1-3
	240/208	3		1-3
	440	3		1-4
	550	3		2-5
PFB500	230	1	1-3	1-3
	220/208	3		1-3
	440	3		1-4
PFB503	230	1	1-3	1-3
	240/208	3		1-4
	440	3		1-4
	550	3		2-5

T Model

Model	HP	Volts	Phase	Resistance Range (Ohms)	
				Start	Both
T63	1/6	115	1	17-20	20-24
		230	1	74-77	87-90
T53	1/5	115	1	17-21	20-24
T55	1/5	115	1	17-21	20-24
		230	1	64-67	76-79

AR Model

Model	HP	Volts	Phase	Resistance Range (Ohms)	
				Start	Both
AR26	1/2	115	1	11-18	12-19
AR4C	1/4	115	1	12-20	14-22
AR43	1/4	115	1	12-20	14-22
		230	1	51-54	59-62

"B" Air Conditioning Model

Model	HP	Volts	Phase	Resistance Range (Ohms)	
				Start	Both
B7516	3/4	115	1	1-10	2-10
B8413	1	115	1	7-10	8-11
B8513	1	115	1	4-7	5-8
B1613	1	115	1	7-10	8-11
		208	1	5-8	7-10
		230	1	5-12	7-13
BB5512E	1	115	1	7-10	8-11
BB1516	1	208	1	5-8	7-10
		230	1	5-8	7-11
B1616	1	208	1	11-14	12-15
		230	1	10-14	11-15
B32516	1-1/2	115	1	3-9	4-10
B32M16	1-1/2	208	1	11-14	12-15
		230	1	9-12	11-14
		230/208	1	9-12	11-14
B32P16	1-1/2	208	1	4-7	5-8
		230	1	3-7	4-8
		240/208	3		1-4
B74P18	1-3/4	208	1	3-6	4-7
		230	1	4-7	5-8
B74T16	1-3/4	208	1	3-6	4-7
		230	1	2-5	3-6
		240/208	3		1-4
B21T18	2	208	1	3-7	4-8
		230	1	2-6	3-7
B21U18	2	208	1	3-7	4-8
		230	1	2-6	3-7
		240/208	3		1-3
B02A	2	208	1	3-7	4-8
		230	1	2-6	3-7
		240/208	3		1-3
B02B	2	230	1	2-6	3-7

"B" & "C" Refrigeration Model

Model	HP	Volts	Phase	Resistance Range (Ohms)	
				Start	Both
B2L16	1/2	115	1	10-13	11-14
C2L16	1/2	240/208	3		4-7
B2513	1/2	115	1	5-8	6-9
		230	1	26-29	29-32
C2513	1/2	115	1	1-4	2-5
		230	1	10-13	13-16
		240/208	3		4-7
B2516	1/2	115	1	5-8	6-9
C2516	1/2	115	1	1-4	2-5
		230	1	10-13	13-16
		240/208	3		4-7
B2616	1/2	115	1	5-13	6-14
		230	1	26-46	29-49
C2616	1/2	115	1	2-5	3-6
		230	1	11-14	14-17
C7P16	3/4	115	1	1-3	1-4
		230	1	5-8	8-11
		240/208	3		3-6
B7T16	3/4	115	1	7-10	7-10
		230	1	31-34	34-37
C7T16	3/4	115	1	1-3	1-4
		230	1	8-11	10-13
		240/208	3		3-6
B7616	3/4	115	1	1-10	2-10
		230	1	20-34	22-37
C7616	3/4	115	1	1-3	1-4
		208	1	6-9	9-12
		230	1	5-11	8-13
		240/208	3		3-6

AT Model

Model	HP	Volts	Phase	Resistance Range (Ohms)	
				Start	Both
AT5C	1/5	115	1	12-20	14-22
		230	1	77-80	87-90
AT4C	1/4	115	1	12-19	14-20
		230	1	53-57	60-64
CAT4C	1/4	115	1	6-9	7-10
		230	1	28-31	34-37
AT43	1/4	115	1	12-19	14-20
		230	1	53-57	60-64
CAT43	1/4	115	1	6-9	7-10
		230	1	19-22	26-29
AT34	1/3	115	1	10-15	11-17
CAT34	1/3	115	1	4-7	5-9
		230	1	26-29	31-34
AT35	1/3	115	1	10-15	11-17
		230	1	43-46	49-52
AT3512	1/3	115	1	12-29	14-31
CAT3512	1/3	115	1	3-6	4-7
AT3J12	1/3	115	1	13-17	14-18
		230/208	1	32-35	36-39
CAT3J12	1/3	115	1	3-6	4-7
		230/208	1	13-16	16-19

AK Model

Model	Volts	Phase	Resistance Range (Ohms)	
			Start	Both
AK5470E	115	1	7-13	7-14
AK5483E	115	1	9-12	10-13
	200	1	9-12	12-15
	230/208	1	7-10	10-13
	277/265	1	8-11	12-15
AK5494E	115	1	8-13	9-14
AK5510E	115	1	4-8	5-9
	230/208	1	4-11	6-13
	277/265	1	8-11	11-14
AK5511E	115	1	4-9	5-10
	230/208	1	9-12	10-13
AK5512E	115	1	5-9	6-9
	200	1	9-12	11-14
	230/208	1	9-12	11-14
	277/265	1	7-12	10-14

AB Model

Model	Volts	Phase	Resistance Range (Ohms)	
			Start	Both
AB5519F	230/208	1	4-8	6-9
	200	1	5-8	6-9
	277/265	1	5-8	7-10
AB5520F	230/208	1	4-8	5-9
	200	1	5-8	6-9
	277/265	1	5-9	6-10
AB5522F	230/208	1	4-7	5-8
	200	1	4-8	5-9
	277/265	1	3-7	5-9
AB5524F	230/208	1	3-6	4-7
	200	1	4-7	4-7
	277/265	1	4-7	5-8

P & AP Models

Model	HP	Volts	Phase	Resistance Range (Ohms)	
				Start	Both
P2019	1/20	115	1	45-48	55-58
P1218	1/12	115	1	16-22	21-28
		230	1	79-104	82-107
P1219	1/12	115	1	16-22	21-28
		230	1	79-104	82-107
P91	1/8	115	1	14-20	18-24
P91		230	1	67-80	86-99
P61	1/6	115	1	13-20	17-24
		230/208	1	78-81	96-99
P6112	1/6	115	1	13-20	17-24
		230/208	1	78-81	96-99
P5112	1/5	115	1	13-21	16-24
		230	1	63-66	75-78
P5311	1/5	115	1	13-21	16-24
P5312	1/5	115	1	13-21	16-24
		230	1	63-66	75-78
AP4111	1/4	115	1	12-17	14-19
		230	1	54-57	61-64
CAP4111	1/4	115	1	6-9	8-11
AP43	1/4	115	1	12-17	14-19
AP3311	1/3	115	1	9-15	10-16
		230	1	43-46	48-51
BP3311	1/3	115	1	9-15	10-16
CAP3311	1/3	115	1	4-7	5-8

AU Model

Model	BTU	Volts	Phase	Resistance Range (Ohms)	
				Start	Both
AU3	6000	115	1	11-15	12-16
		230/208	1	10-13	14-17
AU4	6800	115	1	11-15	12-16
		230/208	1	10-13	14-17
AU14	7050	115	1	9-14	10-15
		230/208	1	11-14	15-18
AU16	8300	115	1	10-16	11-17
		230/208	1	10-13	13-16
AU1612	10000	115	1	3-8	4-8
		208	1	7-10	9-12
		230	1	6-9	9-12
		230/208	1	6-9	9-12
AU1M12	10700	115	1	4-7	4-7
AU1P12	11900	208	1	5-8	7-10
		230	1	5-10	7-12
		277/265	1	7-10	9-12
AU1P13	13200	230/208	1	5-8	7-10
AUR13	14500	208	1	4-8	6-9
		230	1	4-9	5-10

ISM Model

Model	HP	Volts	Phase	Resistance Range (Ohms)	
				Start	Both
S88	1/8	115	1	17-20	20-23
S84	1/8	115	1	17-20	20-23
S64	1/6	115	1	14-17	16-19
		230	1	59-62	70-73
S68	1/6	115	1	14-17	16-19
		230	1	59-62	70-73
S6814	1/6	115	1	14-17	16-19
		230	1	59-62	70-73
S5414	1/5	115	1	13-16	15-18
S5814	1/5	115	1	13-16	15-18
S4414	1/4	115	1	14-20	16-22
		230	1	75-78	82-85
S4614	1/4	115	1	14-20	16-22
		230	1	75-78	82-85
S4814	1/4	115	1	14-20	16-22
		230	1	75-78	82-85
S4N14	1/4	115	1	14-20	16-22
		230	1	75-78	82-85
C4414	1/4	115	1	3-6	5-8
		230	1	17-20	24-27
C4416	1/4	230	1	17-20	24-27
C4614	1/4	115	1	3-6	5-8
		230	1	17-20	24-27
S3414	1/3	115	1	14-24	15-26
		230	1	56-59	62-65
S3814	1/3	115	1	14-24	15-26
		230	1	56-59	62-65
S3N14	1/3	115	1	14-24	15-26
		230	1	56-59	62-65
S3N16	1/3	115	1	14-24	15-26
		230	1	56-59	62-65
C3N14	1/3	115	1	2-5	4-7
		230	1	13-16	19-22
C3N16	1/3	115	1	2-5	4-7
		230	1	13-16	19-22
S2614	1/2	115	1	11-14	12-15
S2S14	1/2	115	1	11-14	12-15
S2N16	1/2	115	1	10-13	11-14
		230	1	43-46	46-49
S2S16	1/2	115	1	5-8	6-9
		230	1	26-29	29-32
S6N14	3/4	115	1	11-14	12-15
S7N16	3/4	115	1	6-9	7-10
		208	1	11-14	13-16
		230	1	10-13	13-16
S7R16	3/4	115	1	6-11	7-12
		208	1	11-16	13-19
		230	1	10-15	13-18
S8N16	3/4	115	1	3-6	4-7
S1T16	1	115	1	7-10	8-11
		208	1	10-13	12-15
		230	1	7-12	9-15

Capacitor Ratings

Never use a capacitor with a lower voltage rating than that specified. A higher voltage rating than that specified is always OK.

Capacitance (MFD) should be as specified.

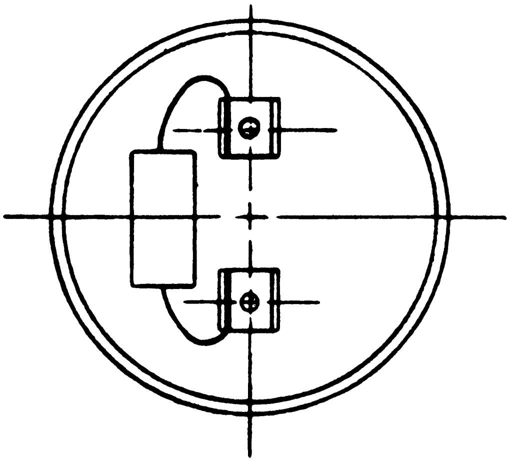
Start Capacitor Bleeder Resistors

The development of high power factor low current single phase compressor motors which require start and run capacitors used with potential type relays created electrical peculiarities which were not known to exist in previous designs.

Under a series of circumstances there is a possibility that the relay contacts weld together causing compressor motor failure.

This phenomenon occurs due to the high voltage in the start capacitor discharging (arcing) across the potential relay contacts. To eliminate this, Tecumseh Products Company start-capacitors are equipped with bleeder resistors wired across the capacitor terminals. No start capacitor used in conjunction with a potential relay and run capacitor should be installed without such a bleeder resistor.

In an emergency where no bleeder resistor equipped capacitors are available, then a two watt 15,000 ohm resistor can be obtained and soldered across the capacitor terminals.



15000 OHMS 2 Watt ± 20%

Bleeder resistor wired across capacitor terminals.

Run Capacitors

The marked terminal of run capacitors should be connected to the "R" terminal of the compressor, and thus to L_2. See wiring diagrams.

Checking Electrical Systems

All the tests indicated should be made with a volt-ohmmeter (Simpson model 260 or equivalent). *NOTE: IT IS IMPORTANT TO DO TESTING IN SAME SEQUENCE AS LISTED!*

Locate relay and overload terminals by indicated letter or number, not by diagrammed position.

Normal Starting Torque Motors (RS1R)
Current Type Relay Mounted on Compressor Terminals

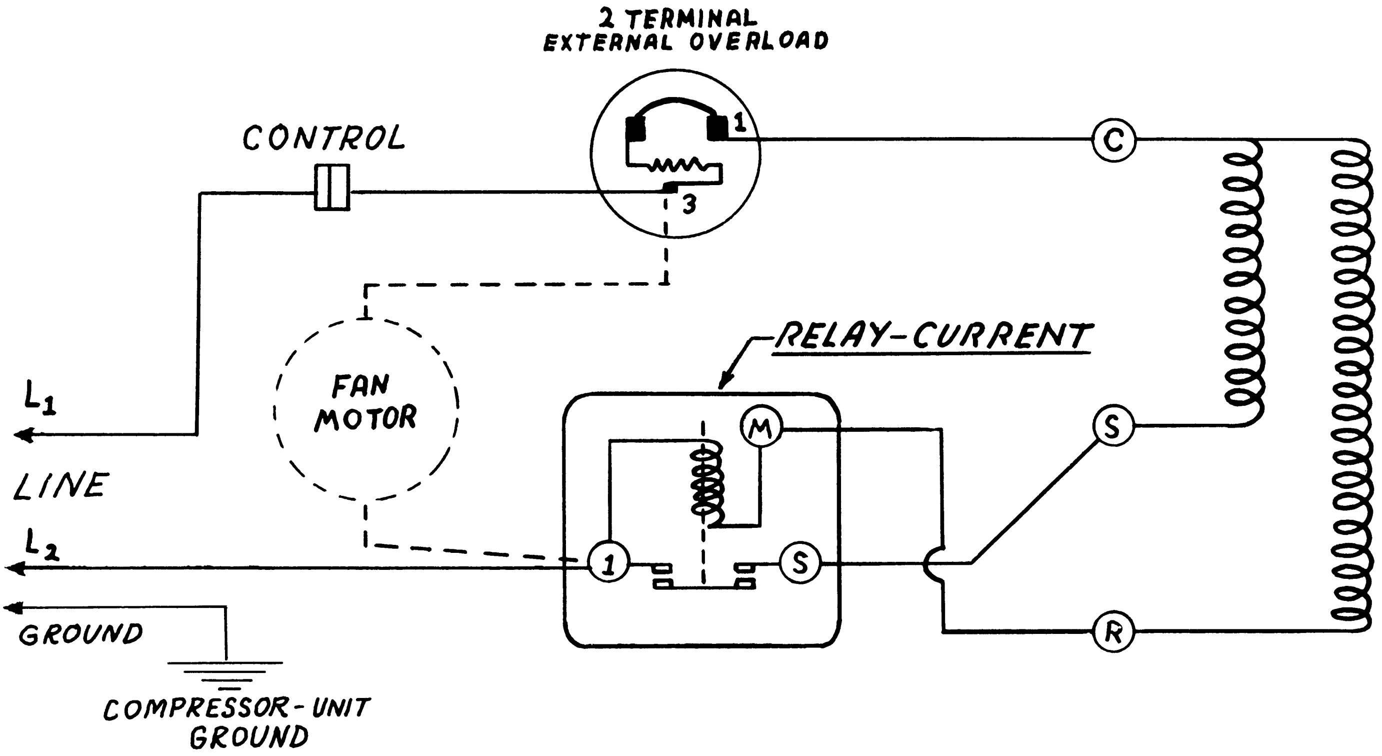


Figure 1

The starting contacts on a current type relay are normally open.

The electrical system on this type of Tecumseh hermetic system (see Fig. 1) can be checked as follows:

Using voltmeter, check power source.

Using ohmeter, check continuity (Unit *not* connected to power and with fan motor circuit opened if one is used), across the following:

1. L_1 and 3—No continuity—close control contacts —still no continuity, replace control.
2. 3 and 1 on overload—No continuity—protector may be tripped—wait 10 minutes—try again—if still no continuity, protector is defective—replace protector.
3. Pull relay off compressor terminals—KEEP UPRIGHT!
4. Relay terminal 1 (or L) and S—if there is continuity—relay contacts closed and should be open —replace relay.
5. 1 (or L) and M. If no continuity—replace relay.
6. Compressor terminals C and R. No continuity—open run winding—replace compressor.
7. C and S—No continuity—open start winding—replace compressor.
8. C and shell of compressor—continuity—grounded motor—replace compressor.
9. Check winding resistance against values given in resistance tables on page 31.

If all above tests prove satisfactory, and there is no capillary restriction, and unit still fails to operate properly, change relay. The new relay will eliminate any faulty electrical characteristics, such as improper pick-up or drop out, which cannot be determined with above tests. If good relay fails to correct difficulty, the compressor shall be considered inoperative because of internal defects and must be replaced.

High Starting Torque Motors (CS1R)
Current Type Relay Mounted on Compressor Terminals

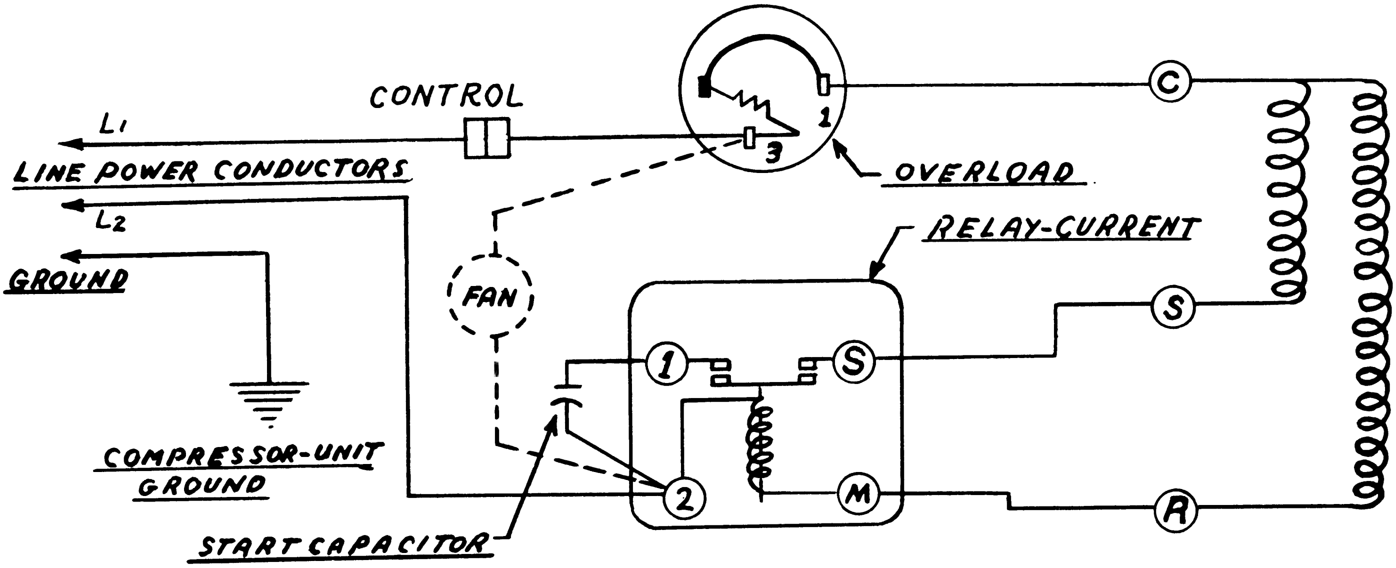


Figure 2

The starting contacts on a current type relay are normally open.

The electrical system on this type of Tecumseh hermetic system (see Fig. 2) can be checked as follows:

Using voltmeter, check power source.

Using ohmmeter, check continuity (Unit *not* connected to power and with fan motor circuit opened if one is used), across the following:

1. L_1 and 3—No continuity—close control contacts —still no continuity, replace control.
2. 3 and 1 on overload—No continuity—protector may be tripped—wait 10 minutes—try again—if still no continuity, protector is defective—replace protector.
3. Pull relay off compressor terminals—KEEP UPRIGHT!
4. Relay terminal 1 and S—if there is continuity—relay contacts closed and should be open—replace relay.
5. Relay terminals 2 and M. If no continuity—replace relay.
6. Compressor terminals C and R. No continuity —open run winding—replace compressor.
7. C and S—No continuity—open start winding—replace compressor.
8. C and shell of compressor—continuity—grounded motor—replace compressor.
9. Check winding resistance against values given in resistance table on page 31.
10. Relay terminals 1 and 2. Meter on R x 1 scale —continuity—shorted capacitor—replace. Meter on R x 100,000 scale—no needle deflection—capacitor open—replace capacitor.

If all above tests prove satisfactory, and there is no capillary restriction, and unit still fails to operate properly, change relay. The new relay will eliminate any faulty electrical characteristics, such as improper pick-up or drop out, which cannot be determined with above tests. If good relay fails to correct difficulty, the compressor shall be considered inoperative because of internal defects and must be replaced.

High Starting Torque Motors—CS1R
2 Terminal External Overload
Potential Relay Mounted Remote

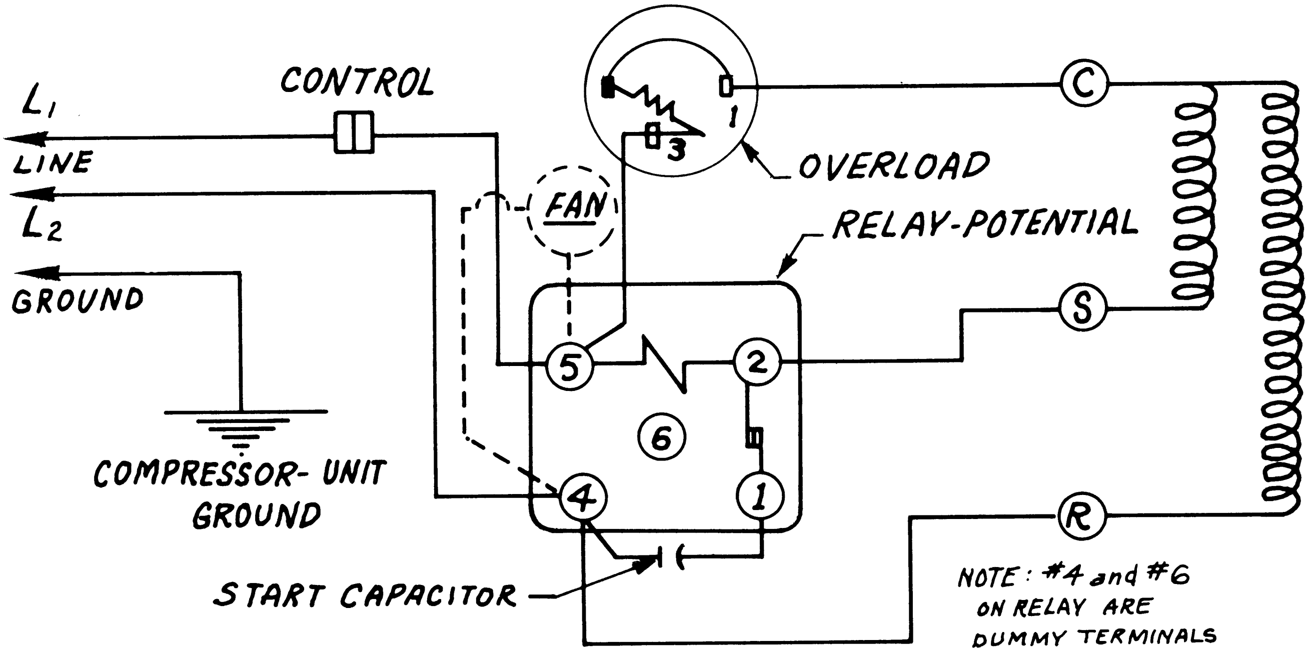


Figure 3

The starting contacts on the potential type relay are normally closed. The electrical system on this type of Tecumseh hermetic system (see Fig. 3) can be checked as follows:

Using voltmeter, check power source.

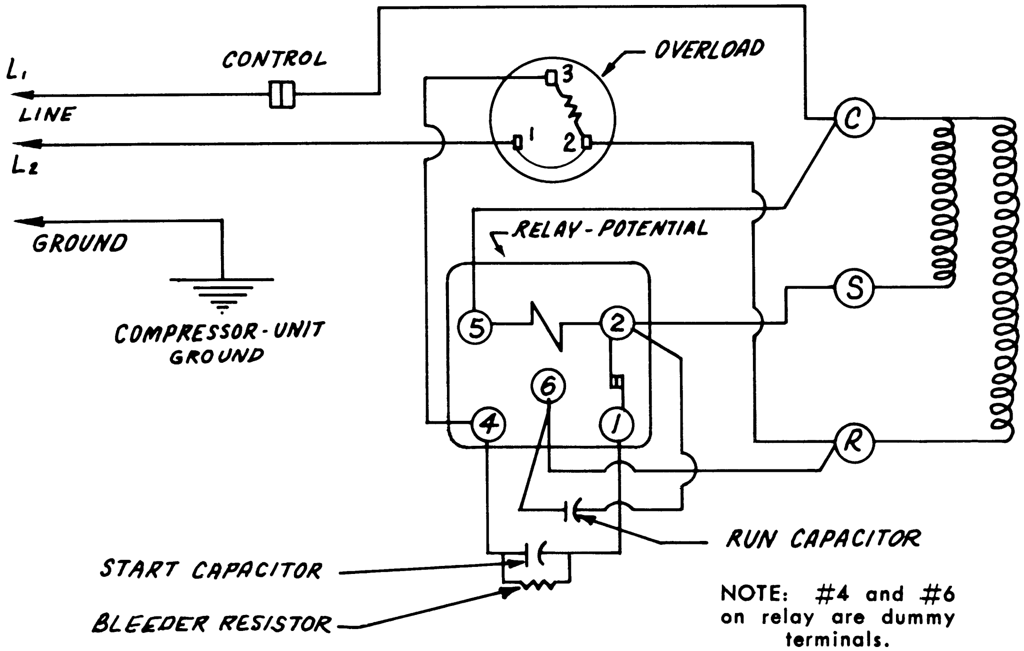
Unplug unit and disconnect leads 2-S and 4-R. Open fan motor circuit if one is used.

Now using ohmmeter, check continuity across the following:

1. L_1 and 3—No continuity—close control contacts —still no continuity, replace control.
2. 3 and 1 on overload—No continuity—protector may be tripped—wait 10 minutes—try again—if still no continuity, protector is defective—replace protector.
3. 3 on overload and 5—No continuity—check leads between 3 on overload and 5.
4. 1 on overload and C—No continuity—check leads between 1 on overload and C.
5. C and S—No continuity—open start winding—replace compressor.
6. C and R—No continuity—open run winding—replace compressor.
7. 5 and 2—No continuity—defective relay—replace relay.
8. 2 and 1 on relay—No continuity—open contacts —replace relay.
9. 1 on relay and 4 on relay with meter on RX1 scale—continuity—shorted Capacitor—replace. Meter on RX100,000 scale—no needle deflection—capacitor open—replace capacitor.
10. C and shell of compressor—continuity—grounded motor—replace compressor.
11. Check motor winding resistance against values given in resistance tables on Page 31.
12. Check continuity of leads 2-S and 4-R and reconnect unit.

If all above tests prove satisfactory and unit still fails to operate properly, change relay as the new relay will eliminate any faulty electrical characteristics, such as improper pick-up or drop out, which cannot be determined by above tests. If good relay fails to correct difficulty, the compressor shall be considered inoperative because of internal defects and must be replaced.

High Starting Torque Motors CSR—3 Terminal External Overloads Potential Relay Mounted Remote



NOTE: #4 and #6 on relay are dummy terminals.

Figure 4

The starting contacts on the potential type relay are normally closed. The electrical system on this Tecumseh hermetic system (see Fig. 4) may be checked as follows:

Using voltmeter, check power source.

Unplug unit and disconnect leads so that no external wiring connects terminals 5-C, S-2 on relay, and R-2 on overload. Using ohmmeter, check continuity across the following:

1. Check continuity across control contacts (i.e., L_1 and C). Control contacts must be closed.
2. 5 and 2 on relay—No continuity—open potential coil—replace relay.
3. 2 and 1 on relay—No continuity—open contacts —replace relay.
4. C and S—No continuity—open start winding—replace compressor.
5. C and R—No continuity—open run winding—replace compressor.
6. 6 and 2 on relay with meter on RX1 scale—continuity—shorted capacitor—replace. Meter on RX100,000 scale—no needle deflection—capacitor open—replace capacitor.
7. 1 on relay and 3 on overload, check same as item 6 above.
8. 1 and 3 on overload—No continuity—if above checking has been done before this, then overload has had sufficient time to reset—replace overload.
9. C and shell of compressor—continuity—grounded motor—replace compressor.
10. Check resistance of motor winding against values given in resistance tables on Page 31.
11. Check continuity of leads removed above and reconnect terminals 5 to C, S to 2 on relay, and R and 2 on overload.

If all above tests prove satisfactory and unit still fails to operate properly, change relay as the new relay will eliminate any faulty electrical characteristics, such as improper pick-up or drop out, which cannot be determined by above tests. If good relay fails to correct difficulty, the compressor shall be considered inoperative because of internal defects and must be replaced.

P.S.C. Motors—2 Terminal External Overload

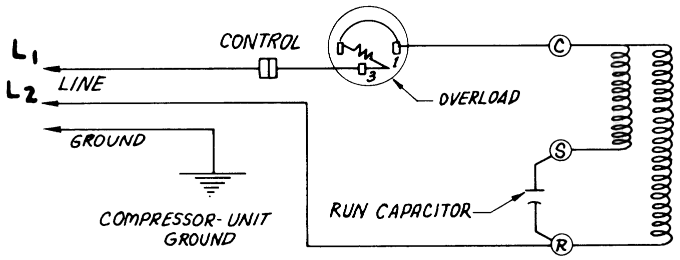


Figure 5

Compressors equipped with 2 terminal external overload, run capacitor, but no start capacitor or relay (see Fig. 5). Relay and start capacitor omitted, two terminals only on overload.

Using voltmeter, check power source.

Unplug unit and disconnect run capacitor from terminals S and R.

Using ohmmeter check continuity across the following:

1. L_1 and 3—No continuity—close control contacts—still no continuity, replace control.
2. C and S—No continuity—open start winding—replace compressor.
3. C and R—No continuity—open run winding—replace compressor.
4. C and 1—No continuity—defective lead.
5. 1 and 3—No continuity—protector may be tripped—wait 10 minutes—try again—if still no continuity, protector is defective—replace protector.
6. C and shell of compressor—continuity—grounded motor—replace compressor.
7. Check motor winding resistance against values given in resistance tables on Page 31.
8. Check across run capacitor with meter on RX1 scale—continuity—shorted capacitor—replace. Meter on RX100,000 scale—no needle deflection—open capacitor—replace capacitor.
9. Reconnect capacitor into circuit at terminals S and R. (Marked terminal should go to R).

P.S.C. Motor—2 Terminal External Overload with Start Components Field Installed

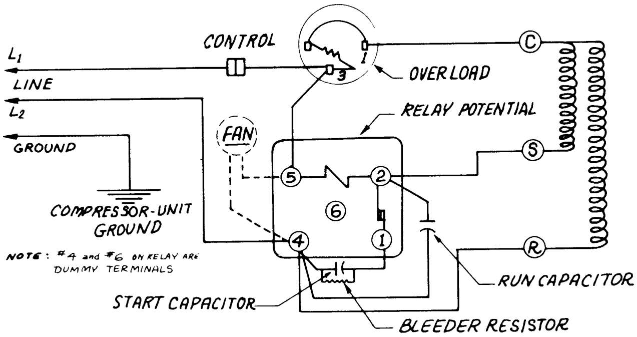


Figure 6

If compressor checks out OK on all the above PSC tests, but still doesn't operate, add proper relay and start capacitor to provide additional starting torque. See Fig. 6 for proper wiring. If unit still fails to operate the compressor shall be considered inoperative because of internal defects and must be replaced.

P.S.C. Motors—Internal Overload (Linebreak)

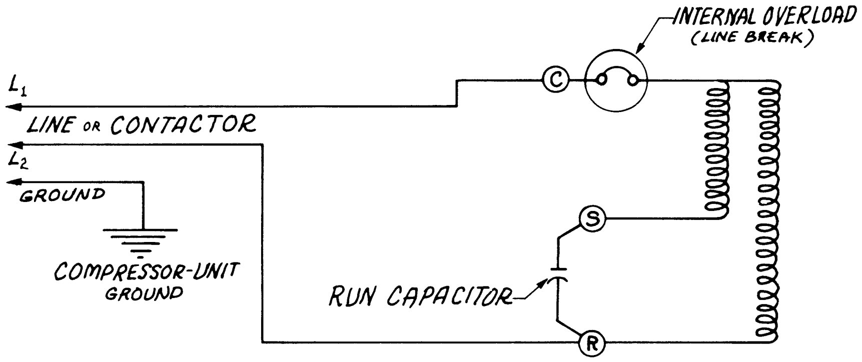


Figure 7

Compressor equipped with internal line break overload, run capacitor, but no start capacitor or relay. (See Figure 7).

1. Using voltmeter, check power source. Check voltage at compressor C to R. If no voltage—control circuit is open.
2. Unplug unit and check continuity across thermostat and/or contactor. Check contactor holding coil.
3. If line voltage is present between terminals C and R and compressor does not operate, unplug unit and disconnect run capacitor from S and R.

   NOTE: The compressor shell MUST be at 130° F. or less for the following checks. This temperature can be read by Tempstik or is that temperature which will allow the hand to remain in contact with the compressor shell without discomfort.
4. Using the ohmmeter, check the following:
   - A. Continuity between R and S. If there is continuity, it can be assumed that both windings are intact. If there is no continuity, it can be assumed that one or both of the windings are open and the compressor should be replaced.
   - B. Continuity between R and C. If no continuity, the internal overload is tripped. Wait for it to cool off and close—it sometimes takes more than an hour.
   - C. If there is continuity between R and S but no continuity between R and C (or S and C) and we are confident that the motor is cool enough (below 130° F.) to have closed the overload, then it can be assumed that the overload is defective and the compressor should be replaced.
   - D. Check continuity between S terminal and compressor shell and between R terminal and compressor shell. If there is continuity in either or both cases, the motor is grounded and the compressor should be replaced.
   - E. Check motor winding resistance against values given in resistance table on page 31.
   - F. Check across run capacitor with meter on R x 1 scale. If there is continuity the capacitor is shorted and should be replaced.
   - G. Check across the run capacitor with meter on R x 100,000 scale. If there is no needle deflection, the capacitor is open and should be replaced.
5. Reconnect run capacitor into circuit at S and R.

CSR or PSC Motor with Start Components
Internal Overload (Linebreak)

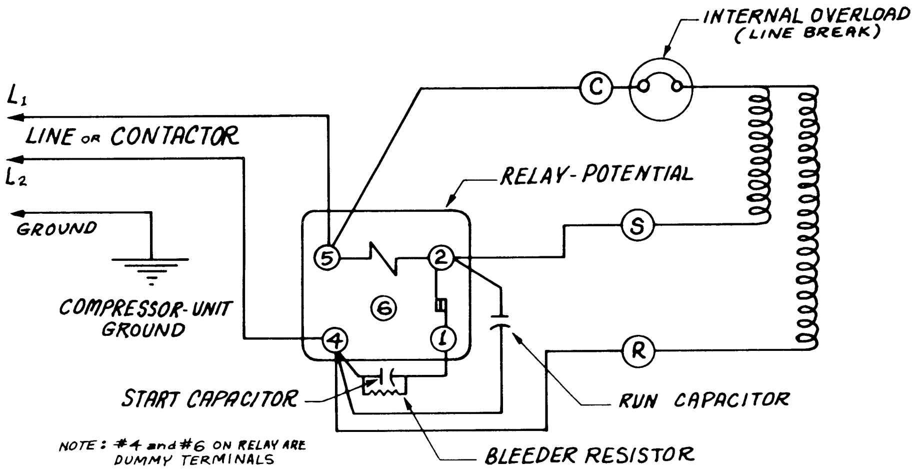


Figure 8

Compressor equipped with internal line break overload, run capacitor, start capacitor and potential relay. (See Figure 8).

1. Using voltmeter, check power source. Check voltage at compressor C to R. If no voltage—control circuit is open.
2. Unplug unit and check continuity across thermostat and/or contactor. Check contactor holding coil.
3. If line voltage is present between terminals C and R and compressor does not operate, unplug unit and disconnect connections to compressor terminals.

   NOTE: The compressor shell MUST be at 130° or less for the following checks. This temperature can be read by Tempstik or is that temperature which will allow the hand to remain in contact with the compressor shell without discomfort.
4. Using the ohmmeter, check the following:
   A. Continuity between R and S. If there is continuity, it can be assumed that both windings are intact. If there is no continuity, it can be assumed that one or both of the windings are open and the compressor should be replaced.

   B. Continuity between R and C. If no continuity, the internal overload is tripped. Wait for it to cool off and close—it sometimes takes more than an hour.

   C. If there is continuity between R and S but no continuity between R and C (or S and C) and we are confident that the motor is cool enough (below 130° F.) to have closed the overload, then it can be assumed that the overload is defective and the compressor should be replaced.

   D. Check continuity between S terminal and compressor shell and between R terminal and compressor shell. If there is continuity in either or both cases, the motor is grounded and the compressor should be replaced.

   E. Check motor winding resistance against values given in resistance table on page 31.

   F. Check across run capacitor with meter on R x 1 scale. If there is continuity the capacitor is shorted and should be replaced.

   G. Check across the run capacitor with meter on R x 100,000 scale. If there is no needle deflection, the capacitor is open and should be replaced.
5. Check continuity across 5 and 2 on relay—no continuity = open potential coil—replace relay.
6. 2 and 1 on relay. No continuity = open contacts—replace relay.
7. 4 and 1 on relay with meter on R x 1 scale—continuity = shorted capacitor—replace. Meter on R x 100,000 scale—no needle deflection = start capacitor open—replace capacitor.

If all above tests prove satisfactory and unit still fails to operate properly, change relay as the new relay will eliminate any faulty electrical characteristics such as improper pick up or dropout which cannot be determined by above tests. If a good relay fails to correct difficulty, the compressor should be considered inoperative because of internal defects and must be replaced.

PSC Motors—Internal Thermostat and Supplementary External Overload

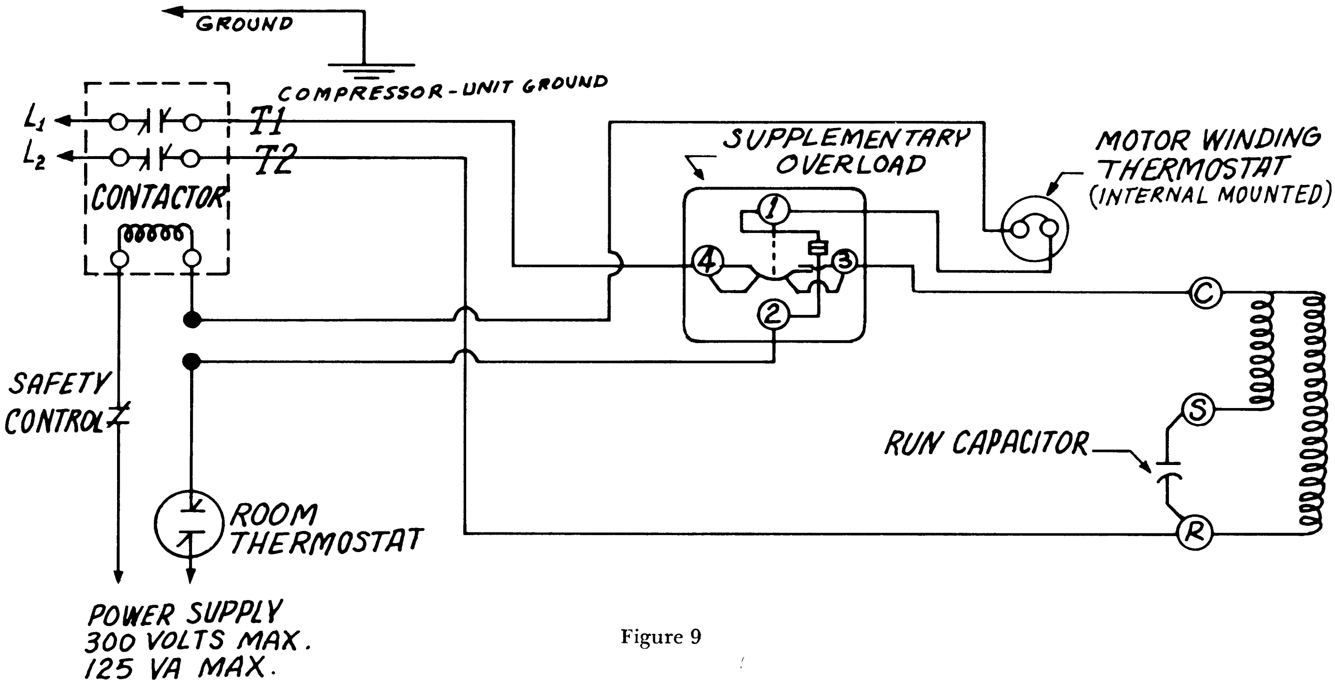


Figure 9

Compressors equipped with internal thermostat, run capacitor and supplementary overload, but no start capacitor or relay (see fig. 9).

The supplementary overload has normally closed contacts connected in series with normally closed contacts of the internal thermostat in motor. Operation of either of these devices will open the control circuit to drop out the contactor. Make sure control thermostat and system safety controls are closed. Using voltmeter, check power source L_1 and L_2 and control circuit power supply. If the contactor is not energized, the contactor holding coil is defective or control circuit is open in either the supplementary overload or the motor thermostat. Unplug unit and disconnect run capacitor from terminals S and R.

Using Ohmmeter, check continuity across the following:

1. 3 and 4—no continuity—supplementary overload is defective—replace overload.
2. 1 and 2—no continuity—overload may be tripped —wait ten minutes—try again—if still no continuity, overload is defective—replace overload.
3. Check across internal (motor winding) thermostat terminals at compressor. See page 22 for compressor terminal identification. If no continuity, the internal thermostat may be tripped. Wait for it to cool off and close—it sometimes takes more than an hour. If the compressor is cool to the touch (below 130° F) and still no continuity, internal thermostat circuitry is open and compressor must be replaced.
4. C and S—no continuity—open start winding—replace compressor.
5. C and R—no continuity—open run winding—replace compressor.
6. C and shell of compressor—continuity—grounded compressor—replace compressor.
7. Check motor winding resistance against values given in resistance tables on Page 31.
8. Check across run capacitor with meter on RX1 scale—continuity—shorted capacitor—replace. Meter on RX100,000 scale—no needle deflection —open capacitor—replace capacitor.
9. Reconnect capacitor into circuit at terminals S and R.

CSR or PSC Motor with Start Components—Internal Thermostat and Supplementary External Overload

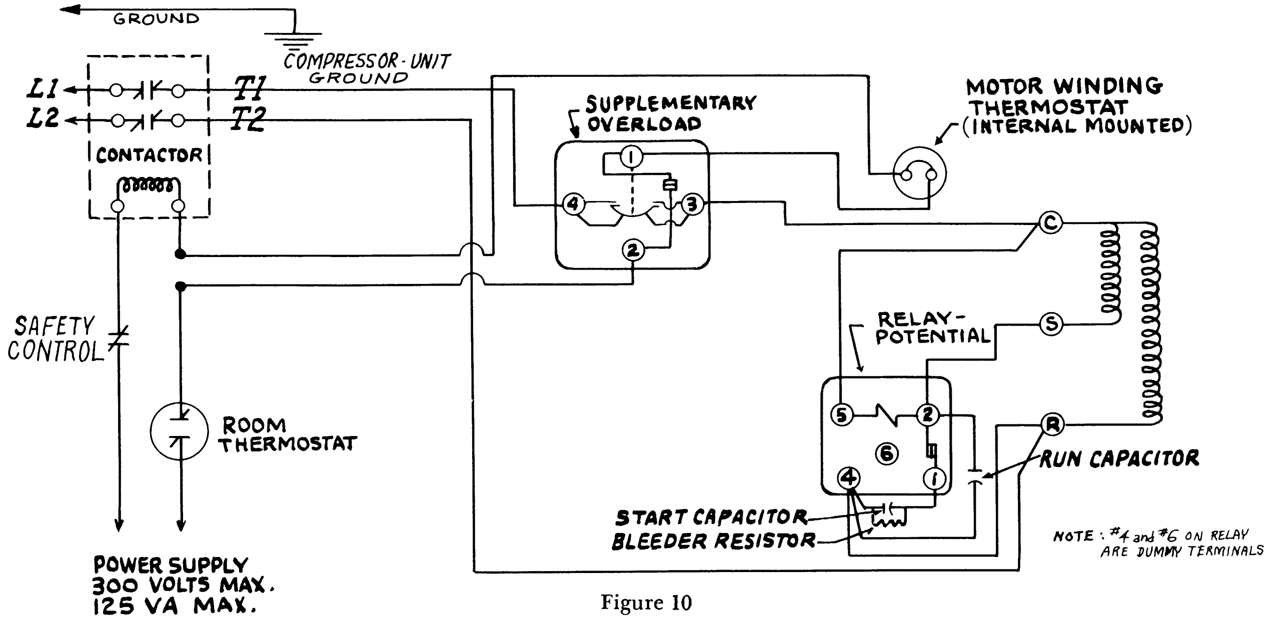


Figure 10

Compressors are equipped with internal thermostat, run capacitor, start capacitor, potential relay, and supplemental overload.

The supplemental overload has normally closed contacts connected in series with normally closed contacts of internal thermostat in motor. Operation of either of these devices will open the control circuit to drop out the contactor.

Make sure the control thermostat and system safety controls are closed. Using voltmeter, check power source, L_1 and L_2, and control circuit power supply. If contactor is not energized, contactor holding coil is defective or control circuit is open in either the supplemental overload or the motor thermostat.

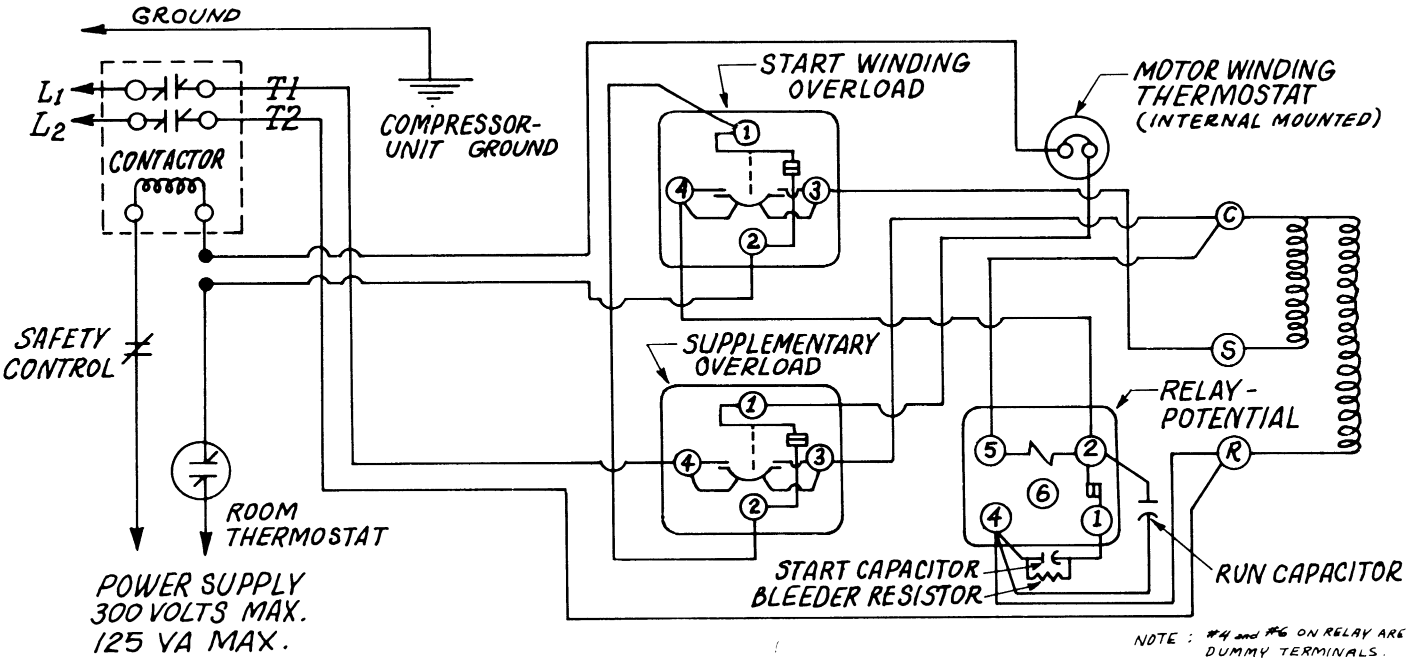
Unplug unit and disconnect connections to compressor terminals.

Using ohmmeter, check continuity across the following:

1. With control circuit power supply off, check continuity of contactor holding coil.
2. 3 and 4 of supplemental overload—no continuity—overload is defective—replace overload.
3. 1 and 2 of overload—no continuity—overload may be tripped—wait at least 10 minutes—try again—if still no continuity, overload is defective—replace overload.
4. Check across internal (motor winding) thermostat terminals at compressor. See page 22 for compressor terminal identification. If no continuity, the internal thermostat may be tripped. Wait for it to cool off and close—it sometimes takes more than one hour. If the compressor is cool to the touch (below 130° F) and still no continuity, internal thermostat circuitry is open and compressor must be replaced.
5. R and S on compressor. If no continuity, one or both windings are open. Change compressor.
6. S terminal and compressor shell. R terminal and compressor shell. If there is continuity in either or both cases the motor is grounded and the compressor should be replaced.
7. Check motor winding resistance against values given in table on page 31.
8. 5 and 2 on relay—no continuity—open potential coil—replace relay.
9. 2 and 1 on relay—no continuity—open contacts—replace relay.
10. 4 and 1 on relay with meter on R x 1 scale—continuity = shorted capacitor—replace. Repeat with meter on R x 100,000 scale—no needle deflection = start capacitor open—replace capacitor.
11. Discharge run capacitor. Remove leads from run capacitor. With meter on R x 1 scale—continuity across capacitor terminals = shorted capacitor—replace. Repeat with meter on R x 100,000 scale. No needle deflection = capacitor open, replace run capacitor.

If all above tests prove satisfactory and unit still fails to operate properly, change relay as the new relay will eliminate any faulty electrical characteristics such as improper pick up or drop out which cannot be determined by above tests. If a good relay fails to correct difficulty, the compressor should be considered inoperative because of internal defects and must be replaced.

CSR or PSC Motor with Start Components—Internal Thermostat Supplemental External Overload and Start Winding Overload



NOTE : #4 and #6 ON RELAY ARE DUMMY TERMINALS.

Figure 11

Compressors are equipped with internal thermostat, run capacitor, start capacitor, potential relay, supplemental overload, and start winding overload.

The diagnosis is identical to Figure 10 (CSR or PSC with start components—Internal thermostat and supplemental overload) excepting there is an additional start winding overload in the control circuit in series with the internal thermostat and supplemental overload.

Check the start winding overload the same way the supplemental overload is checked. See steps 2 and 3 of Figure 10.

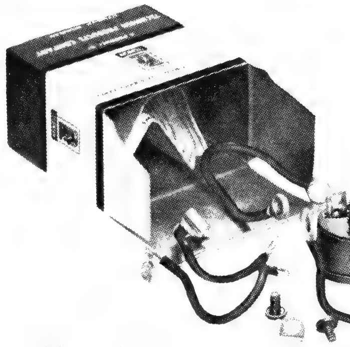
How the Tecumseh ESP Program increases service call profits.

It is estimated that there are more than 100 million Tecumseh compressors operating in the USA.

Although these compressors are designed and built to exacting standards, a small percentage will require service due to normal wear of electrical parts such as relays and overloads. But, each compressor model is designed with a specific BTU rating, operating pressure, and typical duty cycle. Thus, although HP ratings may be the same, replacements must be accurately matched to the specific compressor to assure proper performance. And, mounting hardware and connections are usually quite different.

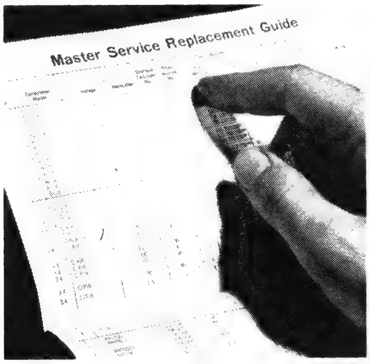
Until a few years ago, such differences presented problems to the serviceman: *if* he had a part with the proper electrical characteristics, he still had to improvise brackets, make up wiring, and perform other on-site modifications. Now, the Tecumseh ESP Program changes all that.

Just 3 simple steps:



1. The right parts.

You get a genuine Tecumseh replacement part with the correct electrical characteristics. A part selected by specific compressor model, and *not* just by HP rating. Plus everything necessary for fast installation, including proper brackets, screws and connecting leads.



2. Easy-to-use tool box reference.

The Tecumseh ESP Guidebook provides a handy cross reference of recommended replacements. Just look up the compressor model number on the compressor nameplate. The book tells you the proper part, then shows easy-to-follow three-dimensional connection drawings. This book alone saves many hours in locating, identifying and installing replacement parts. Anyone with minimum training can do the job.

3. Convenient service-paks.

You can carry stocks of most-used relays and overloads right on the truck. There's a specially cartoned Service-Pak for the most popular domestic refrigerators and freezers, another for small commercial equipment. Each part is separately packed and coded for easy identification and re-stocking. Fewer trips to your wholesaler when you carry Service-Paks.

How to get started—Just see your authorized Tecumseh wholesaler. He'll give you a quick demonstration and help you select the Service-Pak and parts blend which fits your business best.

TECUMSEH
PRODUCTS COMPANY Tecumseh, Michigan

Control of Liquid Refrigerant Migration to Compressor During Shutdown

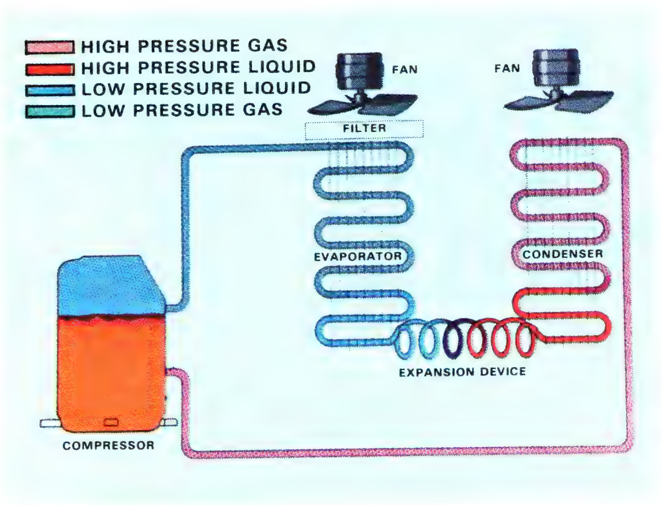


Figure 1

Liquid refrigerant migration to the compressor is a natural occurrence within refrigeration and air conditioning systems. The amount and severity of this liquid refrigerant migration depends on several things, such as size of refrigerant and oil charge and length of shutdown interval.

This discussion shows that while Tecumseh compressors enjoy a fine reputation for reliability and long life, there are application safeguards that can be employed to increase compressor life and eliminate unnecessary service calls.

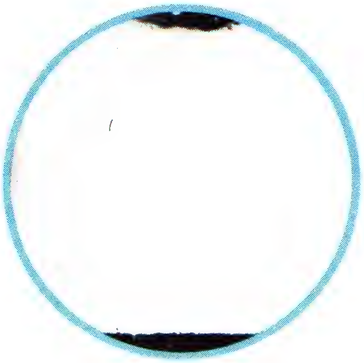
These action photographs were taken in the engineering laboratories of Tecumseh Products Company. A five ton split air conditioning system was used with a four inch sight glass installed in the compressor housing. The condensing unit and evaporator section were connected by approximately twenty-five feet of suction and discharge tubing.

Liquid refrigerant migrates to compressor during shutdown

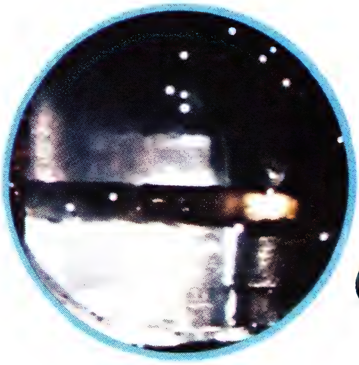
The first internal view shows the system shut down for a week-end. The temperatures of the compressor and evaporator are the same, 76°F.

Even at this condition, the fluid in the evaporator, which is mostly refrigerant, has a higher vapor pressure than the fluid in the crankcase, which is mostly oil. This difference in vapor pressure acts as a driving force for the refrigerant to migrate to the crankcase—to become absorbed in the oil until the pressures are equalized and saturation has been reached.

2. Refrigerant and oil mixture fill sight glass after week-end shutdown.



3. Five seconds after start-up, violent foaming action fills sight glass as refrigerant boils away taking the oil charge with it.



4. More than 60 seconds after start-up, oil level is well below normal operating levels—condition that is an important factor in compressor bearing wear.

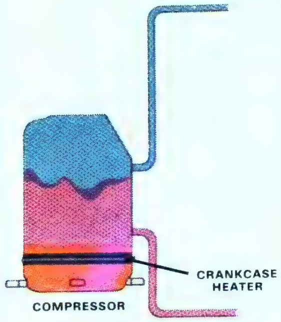
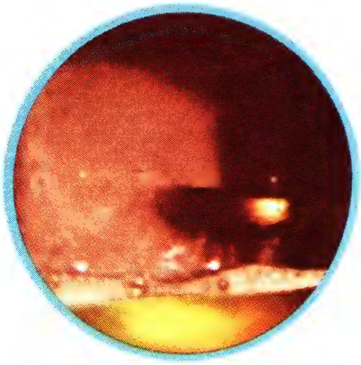


Figure 5

Crankcase heater prevents liquid migration

This sequence shows the effects of an electric strap-on crankcase heater applied to the compressor. The system was again shut down for a week-end under identical conditions, with the exception that the heater was energized throughout the shutdown period. By raising the temperature of the oil we have reduced its ability to attract and hold refrigerant.

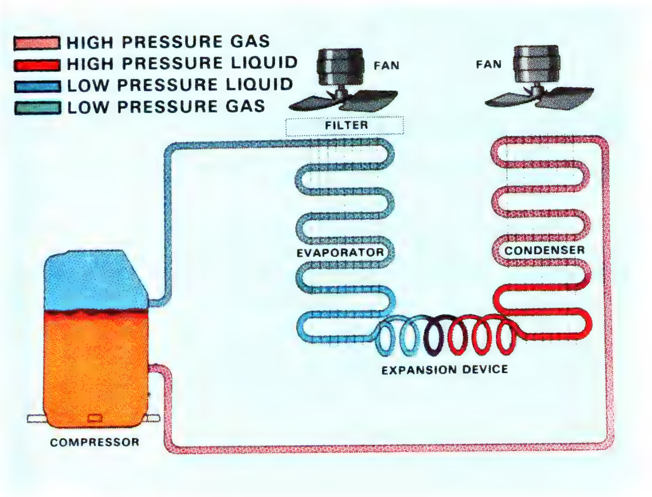
6. View through sight glass shows that the crankcase heater effectively prevents migration of liquid refrigerant to the compressor.



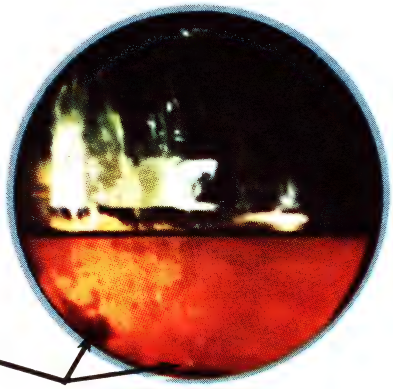
7. Normal run with heat. Oil level is maintained thereby assuring effective lubrication for compressor bearings.

Liquid refrigerant accumulation in the compressor can also be caused by liquid floodback under certain conditions while operating. This condition can be controlled by the application of a suction line accumulator. Crankcase heat does nothing to prevent liquid floodback and an accumulator does nothing to prevent refrigerant migration. Each without the other is half a job—both together provide balanced compressor protection.

Control of Liquid Refrigerant Floodback To The Compressor During Operation



Liquid floodback during operation can be caused by fan failure, or dirty clogged filters that can reduce the heat transfer rate to such a point that the liquid refrigerant floods through, instead of vaporizing. When this situation occurs, liquid refrigerant may enter the compressor under conditions which result in separation of the oil and refrigerant. This separation may result in an accumulation of refrigerant under the oil. Thus, when the compressor is started, the first liquid to be pumped to the bearings will probably be refrigerant, *not* oil. Even if this oil-refrigerant separation does not occur, the large amount of liquid refrigerant in the crankcase will instantly vaporize and boil away the oil charge when the compressor starts. Thereby leaving the compressor oil-starved for many seconds.



Liquid refrigerant enters compressor and settles to the bottom, below the oil

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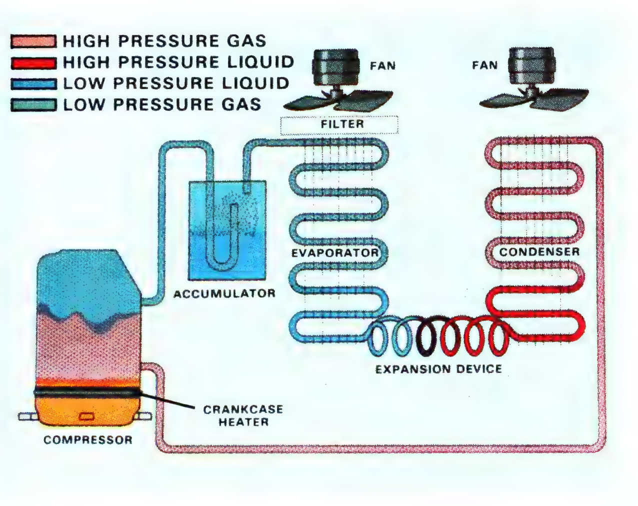
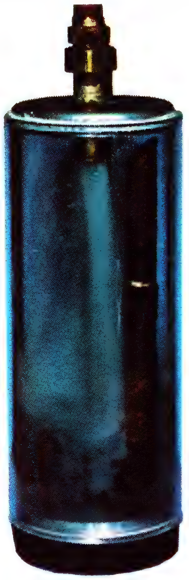


Liquid floodback can be prevented by the application of a properly designed suction line accumulator. For test purposes, Tecumseh engineers fabricated a tempered glass accumulator identical to a standard, commercially available model.

The accumulator placed in the suction line, close to the compressor, intercepts the liquid refrigerant preventing it from entering the compressor. Without the accumulator, the stream of refrigerant, shown **right,** would be spraying directly into the compressor. It is logical to believe that preventing this liquid refrigerant floodback will improve compressor reliability and endurance.

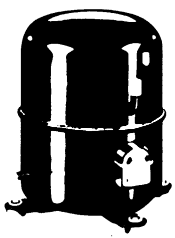


Liquid refrigerant accumulation in the compressor can also be caused by liquid migration to the compressor during periods of shutdown. This condition can be controlled by the application of a crankcase heater. A suction line accumulator does nothing to prevent liquid migration and a crankcase heater does nothing to prevent liquid floodback. Each without the other is half a job—both together provide balanced compressor protection.

Tecumseh Installation and Service Tips

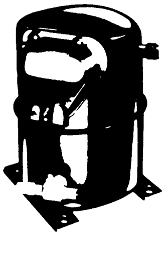
A Discussion of Permanent Spl

Typical PSC Compressors



"AH" Twin Cylinder Two-Pole Compressor

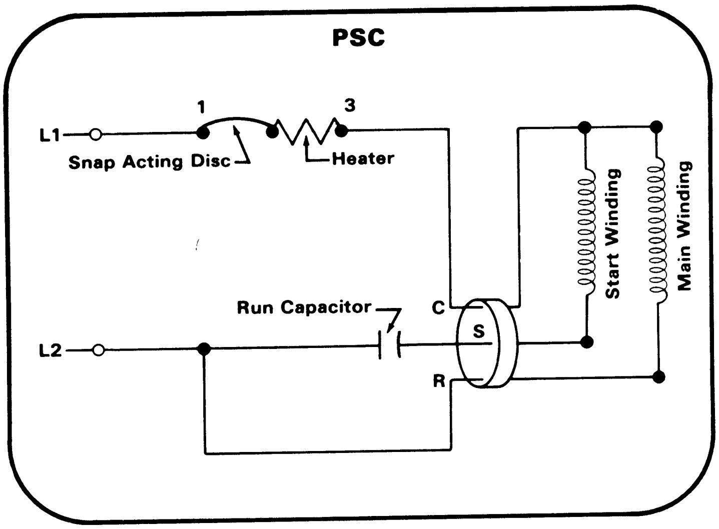
"AJ" Single Cylinder Two-Pole Compressor



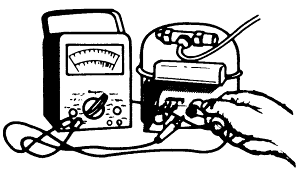
"CL" Twin Cylinder Two-Pole Compressor

Tecumseh Products Company has pioneered in encouraging the development of Permanent Split Capacitor Compressor Motors. This type of motor eliminates the need for potentially troublesome and costly extra electrical components (start capacitors and potential motor starting relays).

To fully realize the capabilities of this simplified type of compressor motor, it is necessary to understand its starting and operating characteristics and the field conditions which can affect it.



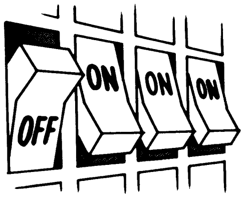
Conditions which affect PSC motor starting:



Low Voltage

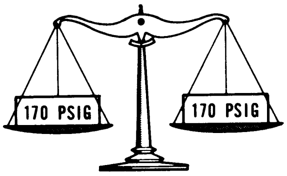
Reduces motor starting and running torque. Torque varies as the square of the voltage (Chart II). Low voltage can cause—no start—slow start—light flicker—TV screen flip-flop.

The minimum voltage required to start a 230 volt or 230/208 volt PSC compressor is 200 volts locked rotor (LRV) measured at compressor terminals. This cannot be measured accurately after compressor starts, only when on locked rotor.



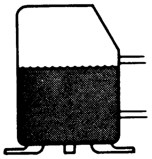
Circuit Breaker or Fuse Trips

Branch circuit fuses or circuit breakers sized too small will cause nuisance tripping, incorrectly diagnosed as compressor "No Start."



Unequalized System Pressure

The maximum *equalized* pressure against which a PSC compressor is designed to start is 170 PSIG. System pressure may not be equalized within three minute design limitation due to—improper refrigerant metering device, excessive refrigerant charge, or, rapid cycling of room thermostat, and compressor will not start.



Starting Load too Great

A number of conditions can cause too great a starting load on a PSC compressor motor. System refrigerant charge may be excessive. Liquid refrigerant may have migrated to compressor and formed a high liquid level in crankcase.

Capacitor Compressor Motors

CAUSES AND CORRECTIONS

LOW VOLTAGE

CAUSES:	**CORRECTIONS:**
1. Inadequate wire size	*Increase wire size (Chart I)*
2. Watthour meter too small	*See utility company*
3. Power transformer too small or feeding too many homes	*See utility company*
4. Input voltage too low	*See utility company*

Note: Starting torque varies as the square of the input voltage (Chart II).

BRANCH CIRCUIT FUSE OR CIRCUIT BREAKER TRIPPING

1. Rating too low	*Increase size to a minimum of 175% of unit FLA (Full load amps) to a maximum of 225% of FLA (Chart III).*

Note: The wire size does not need to be increased due to an increase in size of circuit breaker or fuse (see 1971 National Electric Code, article 240-5, exception #3).

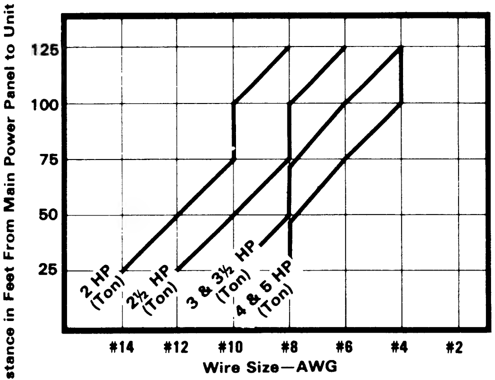
SYSTEM PRESSURE HIGH OR NOT EQUALIZED

1. Pressures not equalizing within three minutes	*a. Check metering device (capillary tube or equalizing expansion valve).* *b. Check room thermostat for cycling rate. Off cycle should be at least five minutes. Also check for "chattering".* *c. Has refrigerant dryer or some other possible restriction been added?*
2. System pressure high	*Make sure refrigerant charge is correct.*
3. Excessive liquid in crankcase (Split-system applications)	*Add crankcase heater and suction line accumulator.*

MISCELLANEOUS

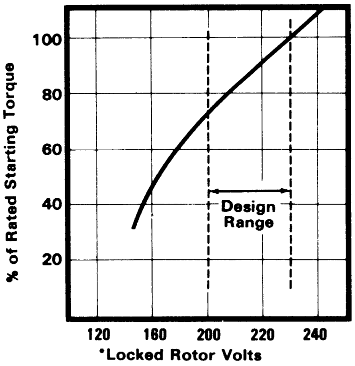
1. Run capacitor open or shorted	*Replace with new, properly-sized capacitor.*
2. Internal overload open	*Allow two hours to reset before changing compressor.*

CHART I



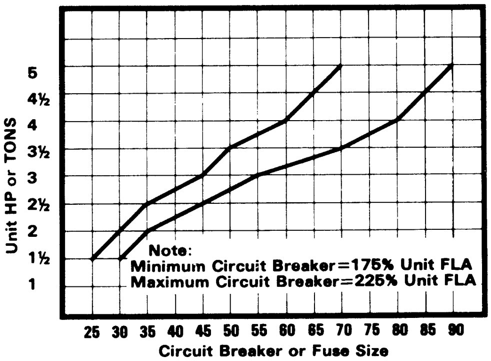
(To Maintain Max. Voltage Drop of 10 Volts Under Locked Rotor Conditions)

CHART II



*(Voltage Measured at Compressor Terminals at Instant of Start)

CHART III



(Time Delay Type Only)

When refrigeration progress is made—
it's made first at Tecumseh

TECUMSEH
PRODUCTS COMPANY Tecumseh, Michigan
Tecumseh Products Canada, Ltd., 185 Ashland Ave., London, Ont.

Hermetic Compressor Field Test

Before a final determination is made to replace and return a hermetic compressor to your compressor source, it is important that the compressor be tested to determine its condition. A replacement service charge is made on all in-warranty as well as out-of-warranty compressors and units that are returned when no defect is found. To avoid this unnecessary expense, loss of time, and inconvenience, it is essential that all compressors be tested prior to their return. Your Tecumseh Wholesaler is equipped to help you make this determination.

The following pages outline the test procedures followed by Tecumseh Wholesalers.

Equipment

Note: Most authorized Tecumseh Wholesalers have a compressor test stand as described below.

1. Variable high voltage transformer (Hi-Pot) for checking for grounds. A suggested source and model is GE Model 9892115G1 or equal.
2. Capacitor check and analyze for checking start and run capacitors for shorts, opens, intermittents and capacitance. A suggested source and model is the Sprague Products Company, North Adams, Mass. Model M-1 Mike-O-Meter.
3. Three voltage and phase variation of power.
   (a) One 115 volt, 60 cycle, single phase.
   (b) One 230 volt, 60 cycle, single phase.
   (c) One 220 volt, 60 cycle, three phase.
4. Two sets of service test cords.
   (a) One 12 ga. two conductor, stranded copper, insulated of suitable lengths with alligator test clips on one end for testing single phase operated compressors.
   (b) One 12 ga. three conductor stranded copper insulated of suitable length with alligator test clips on one end for testing three phase operated compressor.
5. One ammeter having a range of 40 amps. adjustable from 0-10; 0-20 and 0-40 amperes for 220 volt, single phase usage.
6. One by-pass line, including connector tube clamps for discharge and suction line, 200 PSI pressure gauge and control valves as shown in Figure No. 1.
7. Hose adapters as follows:

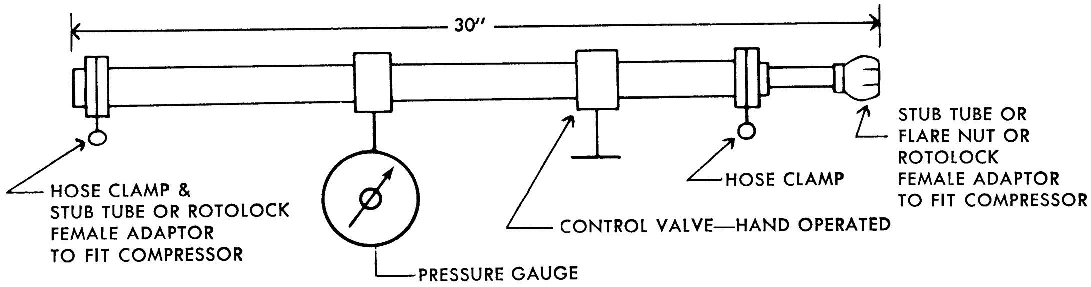

30"
HOSE CLAMP & STUB TUBE OR ROTOLOCK FEMALE ADAPTOR TO FIT COMPRESSOR
PRESSURE GAUGE
CONTROL VALVE—HAND OPERATED
HOSE CLAMP
STUB TUBE OR FLARE NUT OR ROTOLOCK FEMALE ADAPTOR TO FIT COMPRESSOR

Figure 1

8. Four start capacitors having the following rating:
   (a) One of 100 Mfd. 125 Volt rating for ½, ⅓, ¾ H.P. 115 volt rated compressor.
   (b) One of 50 Mfd. 250 volt rating for ⅓, ½, ¾ H.P. 230 volt rated compressor.
   (c) One of 100 Mfd. 250 volt rating for 1, 1½, 1¾, 2 H.P. 230 volt rated compressor.
   (d) One of 200 Mfd. 230 volt rating for 3, 4 and 5 H.P. 230 volt rated compressor.
9. Continuity test cord and lamp per Figure No. 2.
10. Electrical instrument requirements can be covered by model #8500 tester of Airserco Mfg. Co., 3875 Bigelow Blvd., Pittsburgh, Pa. 15213.

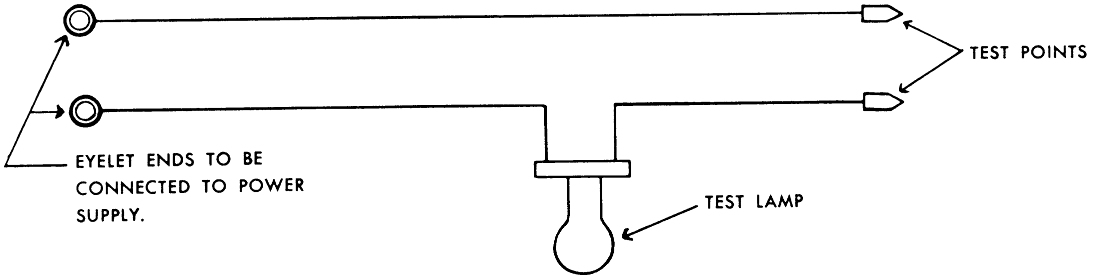


Figure 2

Warranty Test Procedure:

A. High Potential Test

1. Voltage requirements:
   - (a) Use 950 test volts for any compressor having rating up to ½ H.P.
   - (b) Use 1450 test voltage for any compressor having a rating of ½ H.P. and greater.

Method of Testing:

With transformer adjusted to correct specified voltage, attach one lead of tester as a ground by holding it against a non-painted portion of the compressor housing. Touch the other lead for one second to any one of the compressor terminal posts. The high potential ground tester will indicate if ground is present.

If ground is indicated, do not check further. Remove compressor and attach tag #TP620B to it, noting "grounded compressor," and return for replacement.

B. Run Test—If compressor showed no grounds, proceed as follows:

1. Check compressor assembly for correctness of wiring and for loose or broken terminals or joints, changing or repairing where possible.
2. Install by-pass line from suction to discharge line as shown in Figure No. 3 with control valve in line in *full open* position.

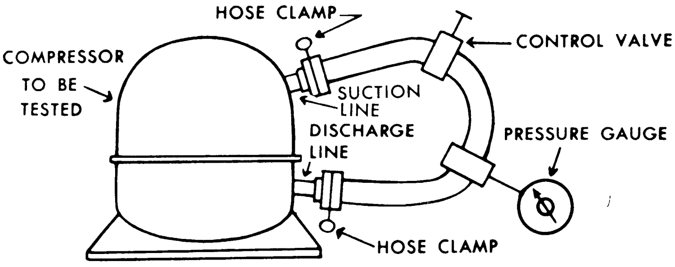


Figure 3

3. Remove all electrical components.
4. Place ammeter in L_1 leg of power supply.
5. Hook up compressor motor to power supply as follows:
   - (a) Single phase:
     - 1) L_1 to C (common) and L_2 to R (run) terminals (See Page 21 for compressor terminal identification)
     - 2) Using proper start capacitor from equipment paragraph 8, connect one capacitor terminal to R and let lead from other capacitor terminal dangle loose. See Figure 4.
     - 3) Energize compressor and momentarily touch loose start capacitor lead to S (Caution: Do not touch start capacitor lead to S for more than a few seconds or start winding will burn.)
   - (b) Three Phase:
     - 1) Connect L_1, L_2 and L_3 to the three compressor terminals.
     - 2) Energize compressor.

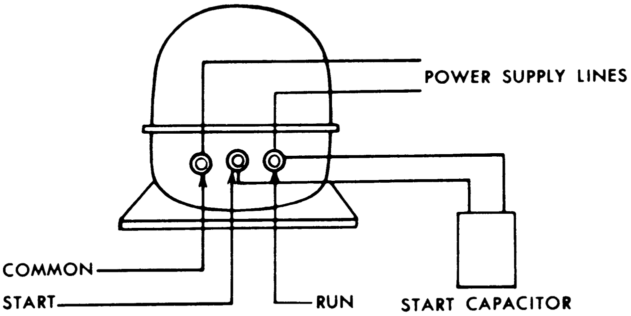


Figure 4

6. Observe the ammeter:
   - (a) If compressor does not run and draws locked rotor amperes (LRA—see serial plate) attach tag #TP620B, noting "stuck" and return for replacement.
   - (b) If compressor runs but is abnormally noisy, attach tag #TP620B, noting "noisy" and return for replacement.
   - (c) If compressor does not run and draws no amps, attack tag #TP620B, noting "open winding" and return for replacement.
7. If compressor runs O.K., close control valve in bypass line until gauge reads about 175 psig. Read amps. If current is more than the rated FLA attach tag #TP620B, noting "high amps" and return for replacement. (See page 21 for amperage draw at rating point of current compressors. For others, take 1/5 of LRA as rough value excepting RSIR which is ⅛.)
8. If current is O.K., and sound normal, close control valve, stop compressor and clock rate of pressure fall on bypass line gauge.

   If initial rate of discharge pressure drop is greater than: 25 psig per minute for models AE, T, AT, AK, AJ, AR, AU, ISM

   40 psig per minute for models AB, AH, B, C, P, and AP

   80 psig per minute for models F and PF

   remove compressor and attach tag #TP620B to it noting "internal leak" and return for replacement.
9. If compressor tests O.K., open control valve in bypass line, remove bypass, and immediately seal the discharge and suction tubes.
10. Check resistance of motor windings against values given on page 31.
11. Return to customer as being a good compressor. (See relay check step #6 page 55.)

Hermetic Compressor Motor Field Test Procedure

Continued

The run (main) windings of a single phase hermetic compressor motor consists of large diameter wire having very low resistance. The accurate measurement of run winding resistance requires laboratory type equipment and is beyond the capabilities of most ohmmeters used in the field.

Motors are sometimes diagnosed as "grounded" when actually the problem lies with the ohmmeter whose sensitivity is incapable of reading the normal 1 or 2 ohm run winding resistance.

There is a test procedure that can be followed to circumvent this measurement problem. This technique also enables the serviceman to determine the operating position of an internal line break overload if one is installed in the motor.

1. Remove all electrical connections from the compressor terminals.
2. Measure the resistance across the "R" (run) and "S" (start) terminals of the motor. (See page 21 for terminal identification.) This measures the combined resistance of the run and start windings.

   If the measured resistance approaches the value given on pages 31 through 35, then the windings can be considered O.K. If no resistance is read, the windings are "open" and the motor should be rejected.
3. If step #2 is O.K., measure the resistance of the start winding only by checking across terminal "S"(start) and "C" (common). The ohms should approach the range given in the table.

   If no resistance is read, the internal common lead to the motor is "open".
   - a. If the motor has an external overload then an "open" common lead means the motor is defective.
   - b. If the motor has an internal line break overload, then the overload may be open because the motor is overly hot.

   Be patient before condemning the compressor because of a defective internal overload. It is not uncommon for the overload to remain open for more than an hour if tripped by a hot motor. Motors cool slowly and the internal overload will not close until the compressor dome (and thus the motor iron) is cool to the touch—below 130° F.
4. If steps 2 and 3 are O.K. then check each terminal in turn for a ground to the compressor housing (file a shiny spot).
5. If steps 2, 3 and 4 are O.K. then it is likely that the problem is not with the single phase motor. 3 phase motors are more difficult to diagnose since all 3 windings are "run" windings with low resistance and the internal overload (if present) is across all 3 windings. The suggested procedure is:

1. Check for continuity between each of the terminal pairs (3).
2. If the circuit is "open" and an internal overload is present be sure the motor is cool before rejecting the motor.
3. If step #1 is O.K., check for ground between each of the terminals and the housing.

Electrical Component Test Procedure

When a compressor is tested without electrical components and found satisfactory, the individual components should then be checked.

1. Check rating and part number of each component to see if they are correct for the model compressor in question. See ESP Master Guide. If incorrect, replace with ESP replacement.
2. External overload (at room temperature) with ohmmeter check for continuity across terminals. No continuity = defective overload. Replace with ESP replacement.
3. Start and run capacitor should be checked on the recommended capacitor tester per the manufacturers instructions.

   An alternate method, not nearly as precise, uses a good ohmmeter. With the meter on the R x 1 scale, continuity = shorted capacitor, replace. With meter on R x 100,000 scale, no needle deflection = open capacitor, replace.
4. Starting relay—It is difficult to check a relay thoroughly unless special equipment is available. Using the ohmmeter continuity checks can be made.

   Current Relays—(Hold upright in operating position)

   Terminals 1 (or L) and S, contacts should be open, therefore no continuity.

   Terminals 2 (or L) and M, should indicate continuity thru the operating coil.

   If no terminal 2, use terminal 1.

Continued

Potential Relays—

Terminals 1 and 2, contacts should be closed, therefore continuity.

Terminals 2 and 5, should indicate continuity thru the operating coil.

5. If all above tests prove satisfactory, change relay. The new relay will eliminate any faulty electrical characteristics, such as improper pick up and drop out, which cannot be determined in the previous tests.
6. As a final check, connect new relay to compressor (and capacitors previously checked if CSIR or CSR). If compressor fails to start at serial plate voltage, the compressor should be considered inoperative because of internal defects and must be replaced. If other than the recommended capacitor checker was used try new capacitors before rejecting the compressor.

R-22 Refrigerant Line Sizes For Remote Systems

Condensers and evaporators should be designed and circuited to maintain adequate velocity to prevent oil trapping in the tubes.

For upflow suction risers, use the next smaller tube size.

The tube sizes suggested below are for remote systems. The basis for selection was to maintain adequate velocity which assures adequate oil return to the compressor, an acceptable pressure drop to assure compressor capacity, and minimum tubing costs.

Length of run (feet)

Liquid Line Sizes

Tecumseh Nominal Compressor Capacity Btu/Hr.	15′	25′	35′	50′	100′
18,500-20,000	5/16	5/16	5/16		
20,000-22,000	5/16	5/16	5/16		
22,000-24,000	5/16	3/8	3/8	3/8	3/8
24,000-34,000	5/16	3/8	3/8	3/8	3/8
38,000-40,000	5/16	3/8	3/8	3/8	3/8
40,000-44,000	3/8	3/8	3/8	3/8	3/8
44,000-51,000	3/8	3/8	3/8	3/8	3/8
53,000-66,000	1/2	1/2	1/2	1/2	1/2
67,000-96,000	1/2	1/2	1/2	1/2	5/8
97,000-120,000	1/2	5/8	5/8	5/8	5/8

Discharge Line Sizes

Tecumseh Nominal Compressor Capacity Btu/Hr.	15′	25′	35′	50′	100′
18,500-20,000	5/16	3/8	3/8		
20,000-22,000	3/8	3/8	3/8		
22,000-24,000	3/8	3/8	3/8	1/2	1/2
24,000-34,000	3/8	3/8	1/2	1/2	1/2
38,000-40,000	3/8	1/2	1/2	1/2	1/2
40,000-44,000	3/8	1/2	1/2	1/2	1/2
44,000-51,000	3/8	1/2	1/2	1/2	5/8
53,000-66,000	1/2	1/2	5/8	5/8	3/4
67,000-96,000	5/8	3/4	3/4	7/8	7/8
97,000-120,000	5/8	3/4	7/8	7/8	7/8

Cooling—Suction Line Heat Pump—Suction or Discharge Line

Tecumseh Nominal Compressor Capacity Btu/Hr.				**Additional Oil Needed(4)**	
	15′	25′	35′	50′	100′
18,500-20,000	5/8	5/8	5/8		
20,000-22,000	5/8	5/8	5/8		
22,000-24,000	5/8	5/8	5/8	3/4	3/4
24,000-34,000	5/8	5/8	3/4	3/4	3/4
38,000-40,000	3/4	3/4	3/4	7/8	7/8
40,000-44,000	3/4	7/8	7/8	7/8	7/8
44,000-51,000	7/8	7/8	7/8	7/8	7/8
53,000-66,000	7/8	7/8	7/8	1-1/8	1-1/8
67,000-96,000	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8
97,000-120,000	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8

(1) These recommendations are based on the use of standard refrigeration tubing with .028 or .032 wall thickness.

(2) Line sizes listed are outside tube dimensions.

(3) These suggestions do not include consideration for additional pressure drop due to elbows, valves, or reduced joint sizes.

(4) Add 3 fl. oz. for each 10′ of suction line over 35′ total.

R-12 Refrigerant Line Sizes
For Remote Systems
Commercial Refrigeration

Cond. Unit CAPACITY BTU/HR.	*SUCTION LINE SIZES AT SYSTEM EVAPORATOR DESIGN TEMPERATURE					Liquid Line Size
	—40°F.	—20°F.	0°F.	+20°F.	+40°F.	
1,200	⅝	½	⅜	⅜	⅜	¼
2,400	¾	⅝	½	½	⅜	¼
3,600	⅞	¾	⅝	½	½	¼
4,800	1⅛	⅞	⅝	⅝	½	¼
6,000	1⅛	⅞	¾	⅝	½	¼
7,200	1⅛	1⅛	⅞	¾	⅝	¼
8,400	1⅜	1⅛	⅞	¾	⅝	⅜
9,600	1⅝	1⅛	⅞	¾	⅝	⅜
10,800	1⅝	1⅛	1⅛	⅞	⅝	⅜
12,000	1⅝	1⅜	1⅛	⅞	¾	⅜
18,000	2⅛	1⅝	1⅛	1⅛	⅞	⅜
24,000	2⅝	2⅛	1⅜	1⅛	1⅛	½
36,000	3⅛	2⅛	1⅝	1⅜	1⅛	½
48,000	3⅝	2⅝	2⅛	1⅝	1⅜	½
60,000	3⅝	2⅝	2⅝	1⅝	1⅜	½
72,000	4⅛	3⅛	2⅝	2⅛	1⅝	½

*The table above shows recommended suction line sizes for installations where that line is horizontal or down flow. In the event the suction line is up flow, use "one standard size" smaller. *EXAMPLE:* Where a ⅞" diameter tube is recommended on the table for horizontal or down flow, the recommended size for up flow would be ¾" diameter.

The recommended suction line sizes are based primarily on the velocities necessary for good oil return. In most instances, the resulting pressure drop will be acceptable for suction lines up to 100′ in length.

Installation considerations for good oil return on commercial systems—

1. Slope horizontal suction line downwards in the direction of the compressor at least ½" fall per 10 feet of line.
2. The setting of the refrigerant control device (expansion valve) should maintain a minimum of superheat. This is typical of the usual direct expansion evaporators where the oil is returned by the refrigerant vapor.

   In the case of a flooded type evaporator (bottom feed, top suction header, large internal volume, low refrigerant/oil velocities) it is necessary to maintain a liquid spillover into the suction line so as to return the oil with the liquid refrigerant and to minimize oil trapping in the evaporator. If because of the spillover, the return gas is "wet" at the compressor, a suction line accumulator should be installed adjacent to the compressor.
3. On systems with evaporators below —10° F. the oil reaches a maximum viscosity when the refrigerant superheat is about 30° F on R-22 and R-502 and when about 45° F. to 60° F. superheat on R-12 systems. Oil may return sluggishly in such cases because of the high viscosity. Two solutions should be considered:
   - (a) Reduce superheat.
   - (b) Add a liquid to suction gas heat exchanger close to the evaporator but outside the refrigerated space.
4. On multiple evaporator systems, prevent the oil (and refrigerant) from collecting in an idle coil. If the evaporator coils are to operate independently of each other, each should have its own suction riser sized to the coil's capacity.
5. Insulate suction lines.

CAPILLARY TUBE SIZING

I. Suggested Restrictor Tube Data for Domestic and Commercial Applications.

The suggestions below, using a minimum of 36″ heat exchange and 0° sub-cooling are made to aid in the initial selection of restrictor in system design:

R-12 LOW TEMPERATURE

Compressor Capacity BTU/Hr	Condenser Type	NORMAL EVAPORATING TEMPERATURE	
		−10° to +5°	+5° to +20°
200-300	Static (Fan)	16′ - .026″	10′ - .026
300-400	Static (Fan)	12′ - .026	12′ - .031
400-700	Static	12′ - .031	12′ - .036
	Fan	10′ - .031	10′ - .036
700-1100	Static	12′ - .036	
	Fan	10′ - .036	
1100-1300	Static	10′ - .036	
	Fan	8′ - .036	
1300-1700	Static	12′ - .042	
	Fan	10′ - .042	
1700-2000	Static	12′ - .049	
	Fan	10′ - .042	
2000-3000	Fan	10′ - .054	15′ - .059
3000-4000	Fan	10′ - .059	12′ - .064
4000-4500	Fan	12′ - .064	12′ - .070
4500-5000	Fan	10′ - .070	12′ - .080
5000-7000	Fan	(2 pcs.) 10′ - .059	(2 pcs.) 12′ - .064
7000-9000	Fan	(2 pcs.) 10′ - .064	(2 pcs.) 10′ - .070
9000-12,000	Fan	(2 pcs.) 10′ - .070	(2 pcs.) 12′ - .080
12,000-15,000	Fan	(3 pcs.) 10′ - .070	(3 pcs.) 12′ - .080

R-22 LOW TEMPERATURE

1000-2000	Fan	10′ - .036	12′ - .042
2000-3000	Fan	12′ - .042	15′ - .049
3000-4000	Fan	10′ - .054	15′ - .059
4000-5000	Fan	10′ - .064	15′ - .070

R-12 MEDIUM & HIGH TEMPERATURE

Compressor Capacity BTU/Hr	Condenser Type	NORMAL EVAPORATING TEMPERATURE		
		+5° to +20°	+20° to +35°	+35° to +50°
1400-1600	Fan	12′ - .036	8′ - .036	8′ - .042
1600-1800	Fan	10′ - .036	12′ - .042	
1800-2500	Fan	12′ - .042	12′ - .049	8′ - .049
2500-3500	Fan	10′ - .042	10′ - .049	
3500-4000	Fan	12′ - .049	10′ - .054	
4000-5000	Fan	10′ - .054	10′ - .059	
5000-6000	Fan	12′ - .059	12′ - .064	
6000-7000	Fan	10′ - .059	10′ - .064	12′ - .070
7000-10,000	Fan	12′ - .070	12′ - .080	
		(2 pcs.) 12′ - .054	(2 pcs.) 10′ - .059	
10,000-13,000	Fan	(2 pcs.) 12′ - .059	(2 pcs.) 10′ - .064	
13,000-16,000	Fan	(2 pcs.) 12′ - .070	(2 pcs.) 10′ - .080	
16,000-25,000	Fan	(2 pcs.) 12′ - .080	(2 pcs.) 10′ - .085	
25,000-40,000	Fan	(4 pcs.) 10′ - .070	(4 pcs.) 12′ - .080	
40,000-60,000	Fan	(5 pcs.) 10′ - .070	(5 pcs.) 12′ - .080	

II. Suggested Restrictor Tube Data for Air Conditioning (R-22) Applications.

The suggested capillary size is based on a condensing temperature of 130°F, with 115°F liquid entering the capillary, 65°F gas entering the compressor. and evaporator refrigerating effect of 68 BTU/#.

Example No. 1 (See table below)

Select the capillary required for a Tecumseh compressor AH5540E rated 40,000 BTU/Hr.

Assuming a 3/8″ O.D. tube coil. The maximum load per circuit is 7000 BTU/Hr. or 40,000 ÷ 7000 or six circuits. The load per circuit then becomes 40,000 ÷ 6 or 6700 BTU per circuit.

(a) For each circuit the capillary would be 35″ × .049 or 65″ × .054.

(b) As an option two capillaries could be used to distribute into six circuits in the coil. The load per capillary becomes 40,000 ÷ 2 or 20,000 BTU/Hr. The capillary is 40″ × .080 or 58″ × .085.

Example No. 2

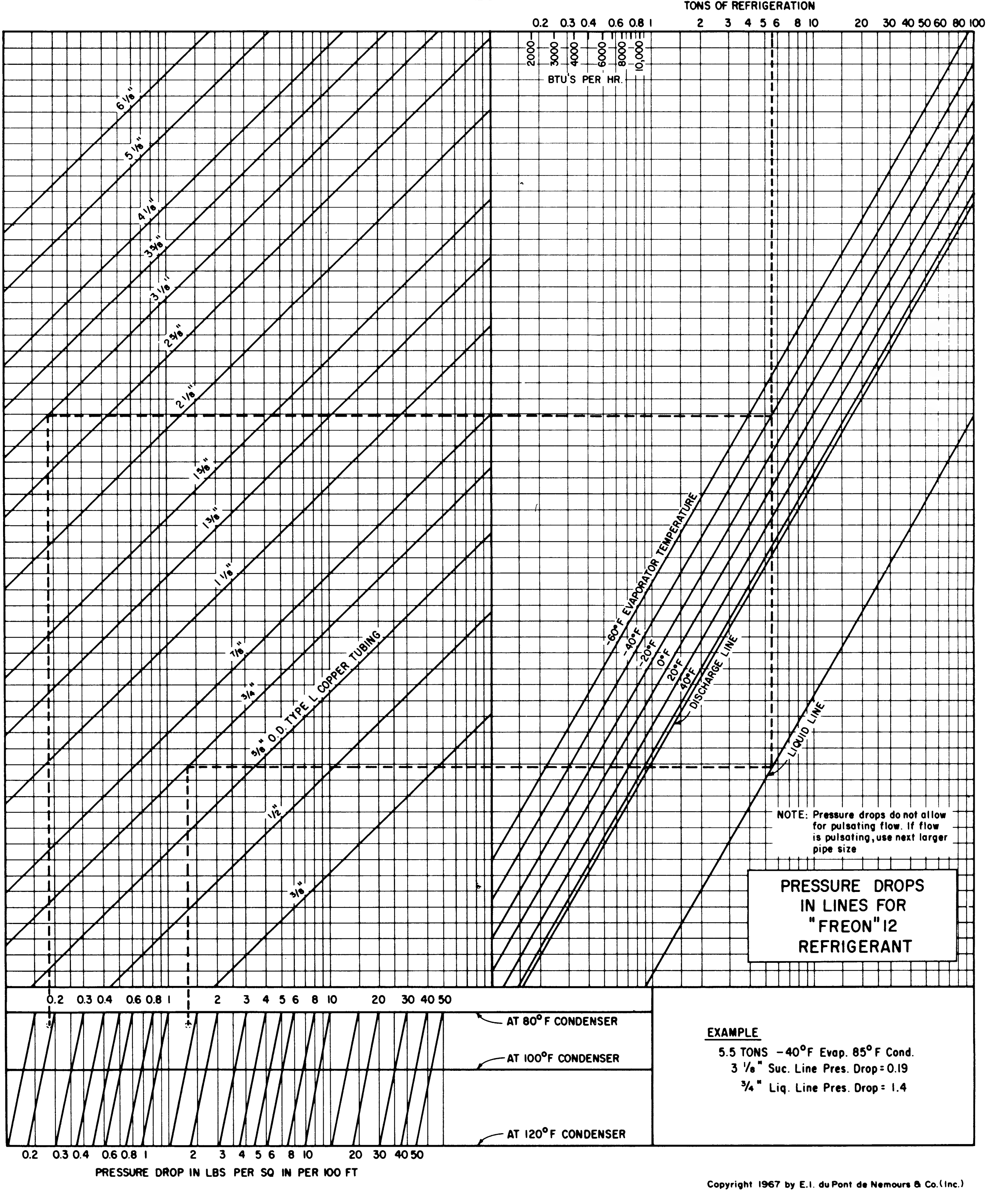
Select the capillary required for a Tecumseh compressor CL5562E rated 62,000 BTU/Hr.

Assuming a 3/8″ O.D. tube coil. The maximum load per circuit is 7000 BTU/Hr. or 62,000 ÷ 7,000 or 8.9 circuits (use 10). The loading per circuit becomes 6200 BTU/Hr. Use 40″ × .049 or 75″ × .054 if the intention is to feed each circuit with a separate cap tube. Fewer number of cap tubes are optional, of course.

Assuming a 1/2″ O.D. tube coil. The maximum load per circuit is 14,000 BTU/Hr. or 62,000 ÷ 14,000 or 4.5 circuits. Use five circuits, 62,000 ÷ 5 or 12,400 BTU/Hr. per circuit. Use 40″ × .064 or 68″ × .070 if the intention is to feed each circuit with a separate cap tube. Fewer number of cap tubes are optional, of course.

Compressor Capacity BTU/Hr.	No. of Capillaries	Capillary Size		Coil Circuits	
		Short	Long	3/8″ Tube	1/2″ Tube
4500	1	36″ × .042	80″ × .049	1	
5000	1	25″ × .042	64″ × .049	1	
5500	1	20″ × .042	52″ × .049	1	
6000	1	40″ × .049	75″ × .054	1	
6500	1	35″ × .049	65″ × .054	1	
7000	1	28″ × .049	52″ × .054	1	
8000	1	36″ × .054	65″ × .059		1
9000	1	28″ × .054	48″ × .059	2	1
10,000	1	36″ × .059	64″ × .064	2	1
11,000	1	28″ × .059	50″ × .064	2	1
12,000	1	40″ × .064	68″ × .070	2	1
13,000	1	32″ × .064	56″ × .070	2	1
14,000	1	44″ × .070	70″ × .075	2	1
15,000	1	36″ × .070	56″ × .075	3	2
16,000	1	30″ × .070	48″ × .075	3	2
17,000	1	38″ × .075	65″ × .080	3	2
18,000	1	35″ × .075	55″ × .080	3	2
19,000	1	28″ × .075	48″ × .080	3	2
20,000	1	40″ × .080	58″ × .085	3	2

"FREON" 12



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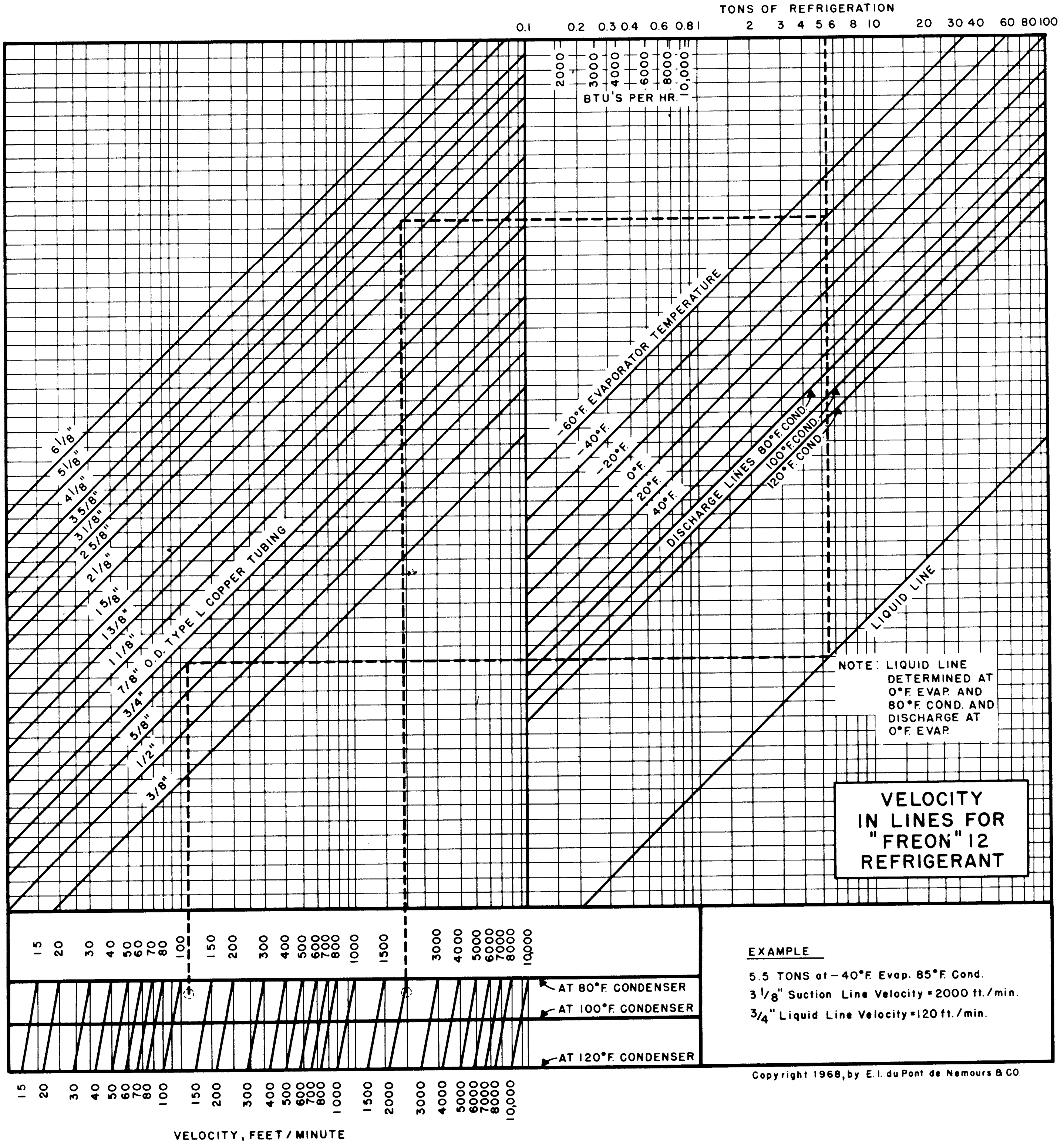
"FREON" 12 REFRIGERANT



NOTE: LIQUID LINE DETERMINED AT 0°F. EVAP. AND 80°F. COND. AND DISCHARGE AT 0°F. EVAP.

VELOCITY IN LINES FOR "FREON" 12 REFRIGERANT

EXAMPLE

5.5 TONS at -40°F. Evap. 85°F. Cond.
3 1/8" Suction Line Velocity = 2000 ft./min.
3/4" Liquid Line Velocity = 120 ft./min.

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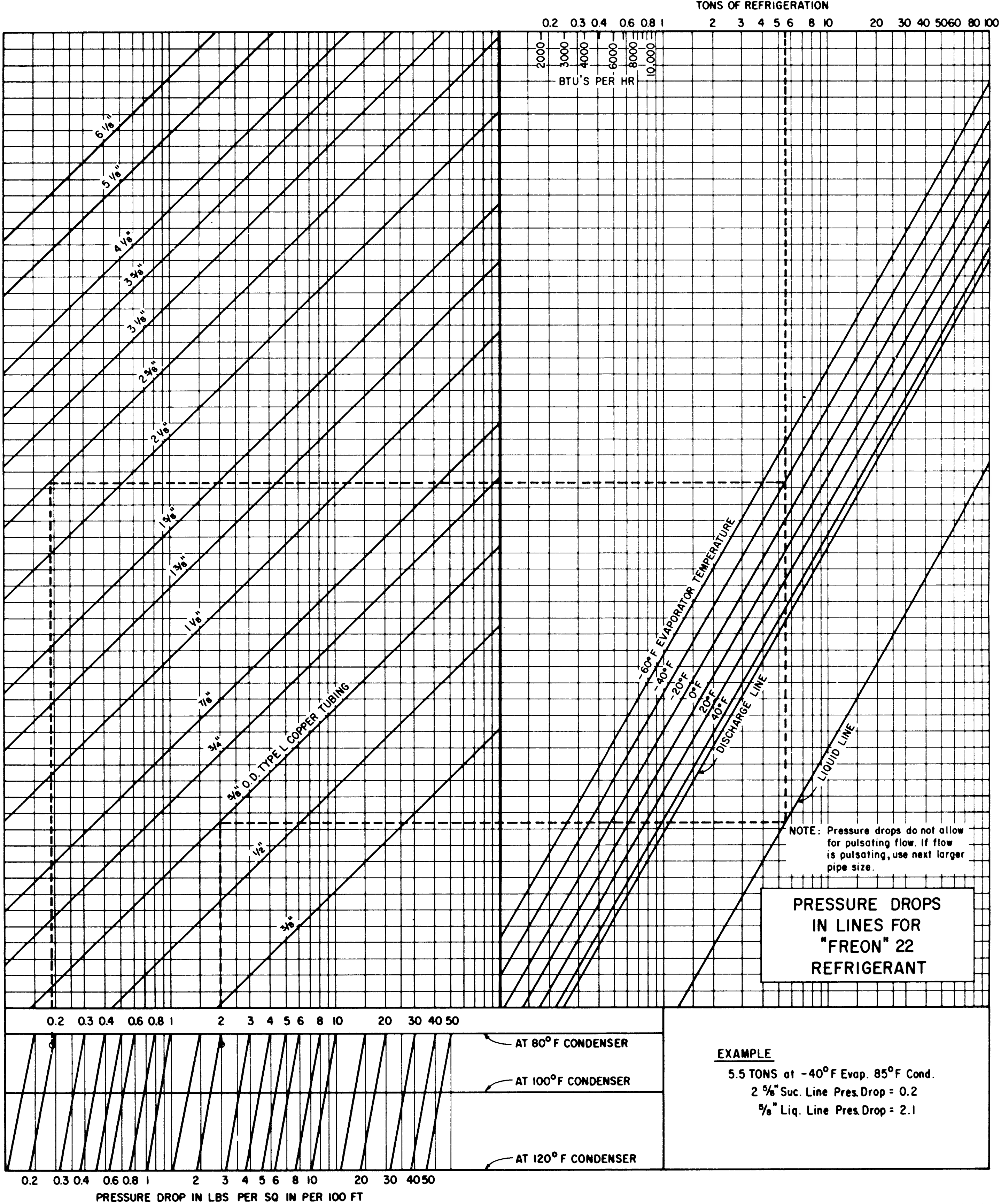
"FREON" 22



NOTE: Pressure drops do not allow for pulsating flow. If flow is pulsating, use next larger pipe size.

EXAMPLE

5.5 TONS at -40°F Evap. 85°F Cond.
2 5/8" Suc. Line Pres. Drop = 0.2
5/8" Liq. Line Pres. Drop = 2.1

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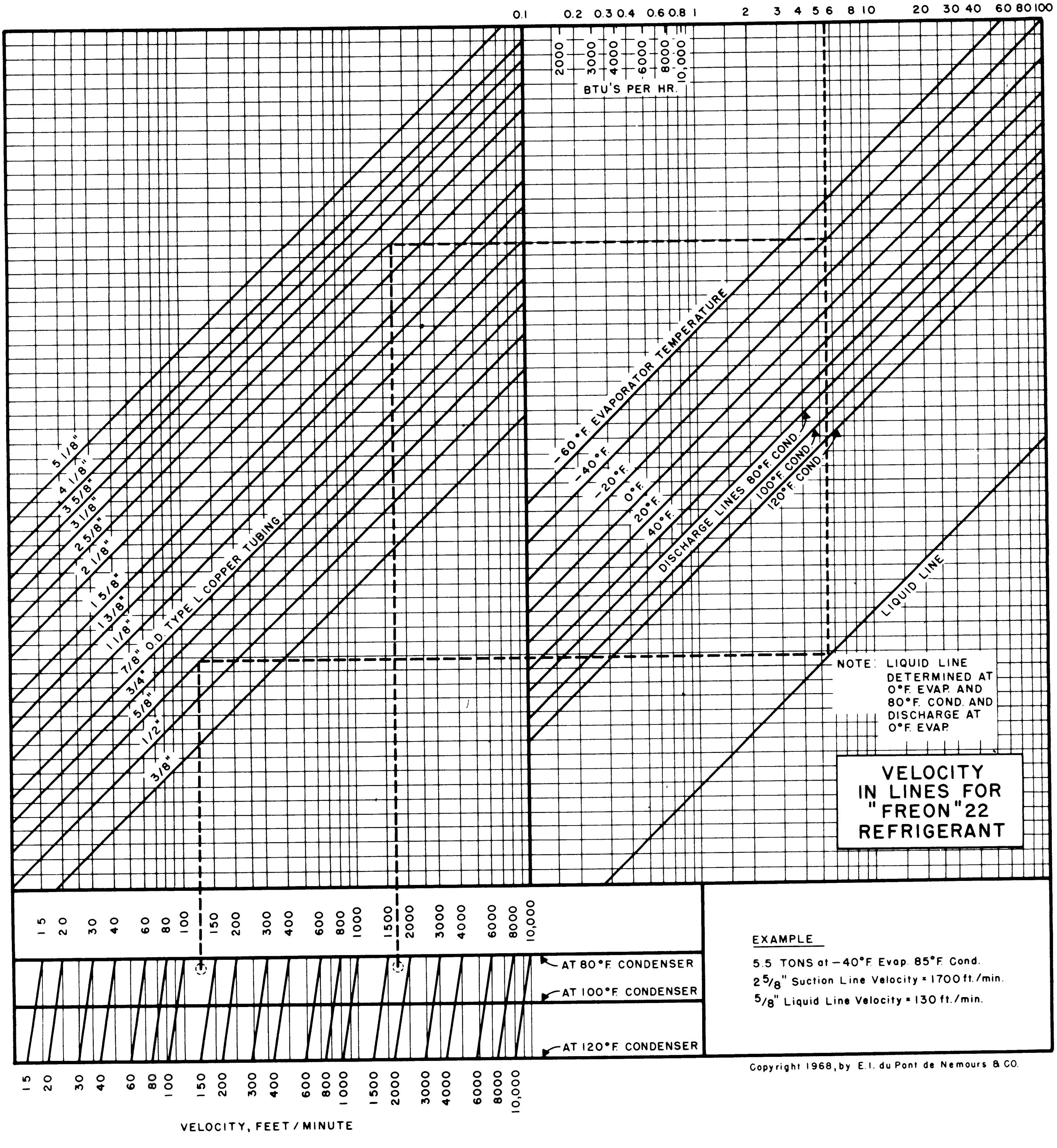
"FREON"22 REFRIGERANT



EXAMPLE

5.5 TONS at -40°F. Evap. 85°F. Cond.

2 5/8" Suction Line Velocity = 1700 ft./min.

5/8" Liquid Line Velocity = 130 ft./min.

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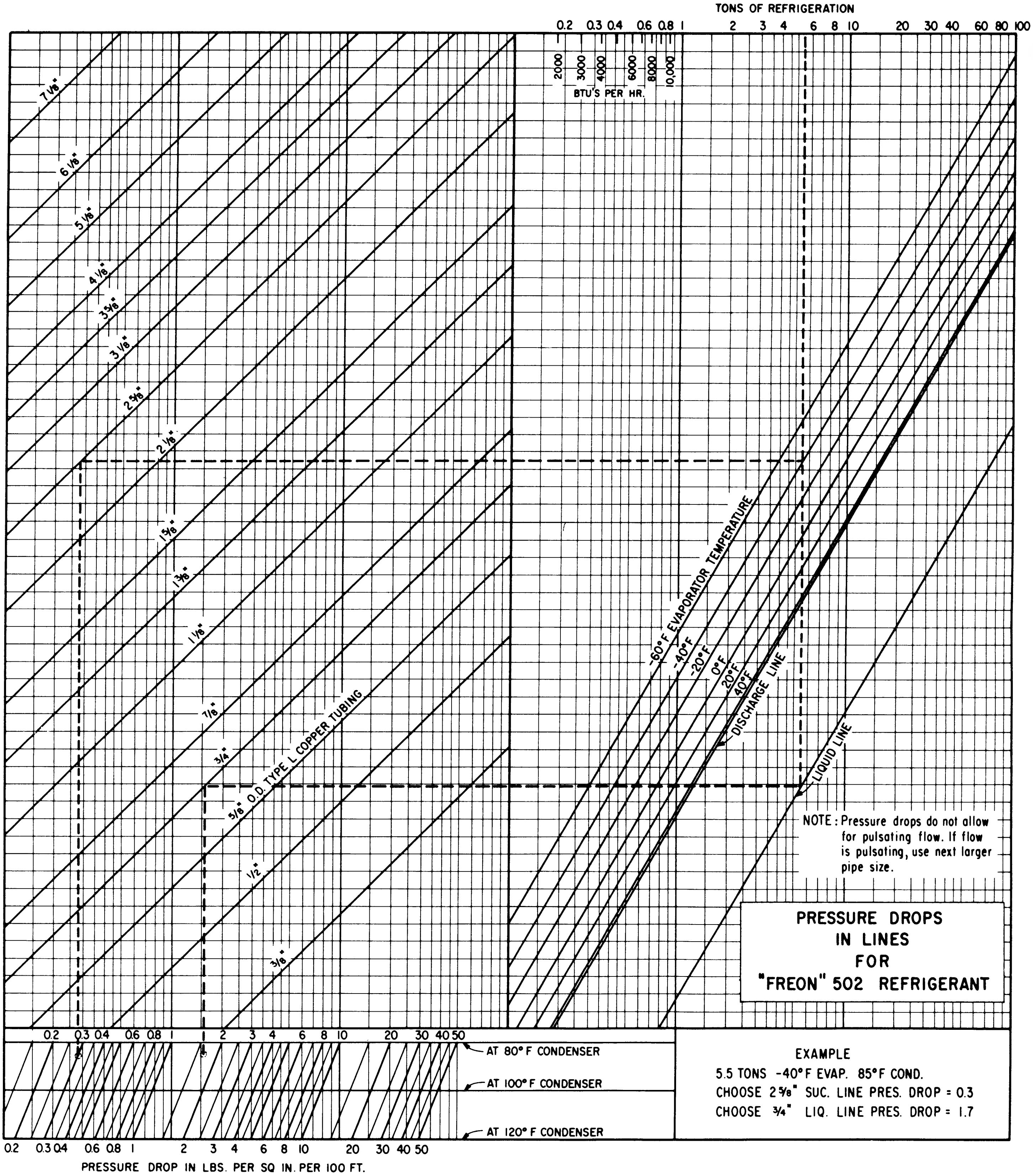

NOTE: Pressure drops do not allow for pulsating flow. If flow is pulsating, use next larger pipe size.

PRESSURE DROPS
IN LINES
FOR
"FREON" 502 REFRIGERANT

EXAMPLE
5.5 TONS -40°F EVAP. 85°F COND.
CHOOSE 2 5/8" SUC. LINE PRES. DROP = 0.3
CHOOSE 3/4" LIQ. LINE PRES. DROP = 1.7

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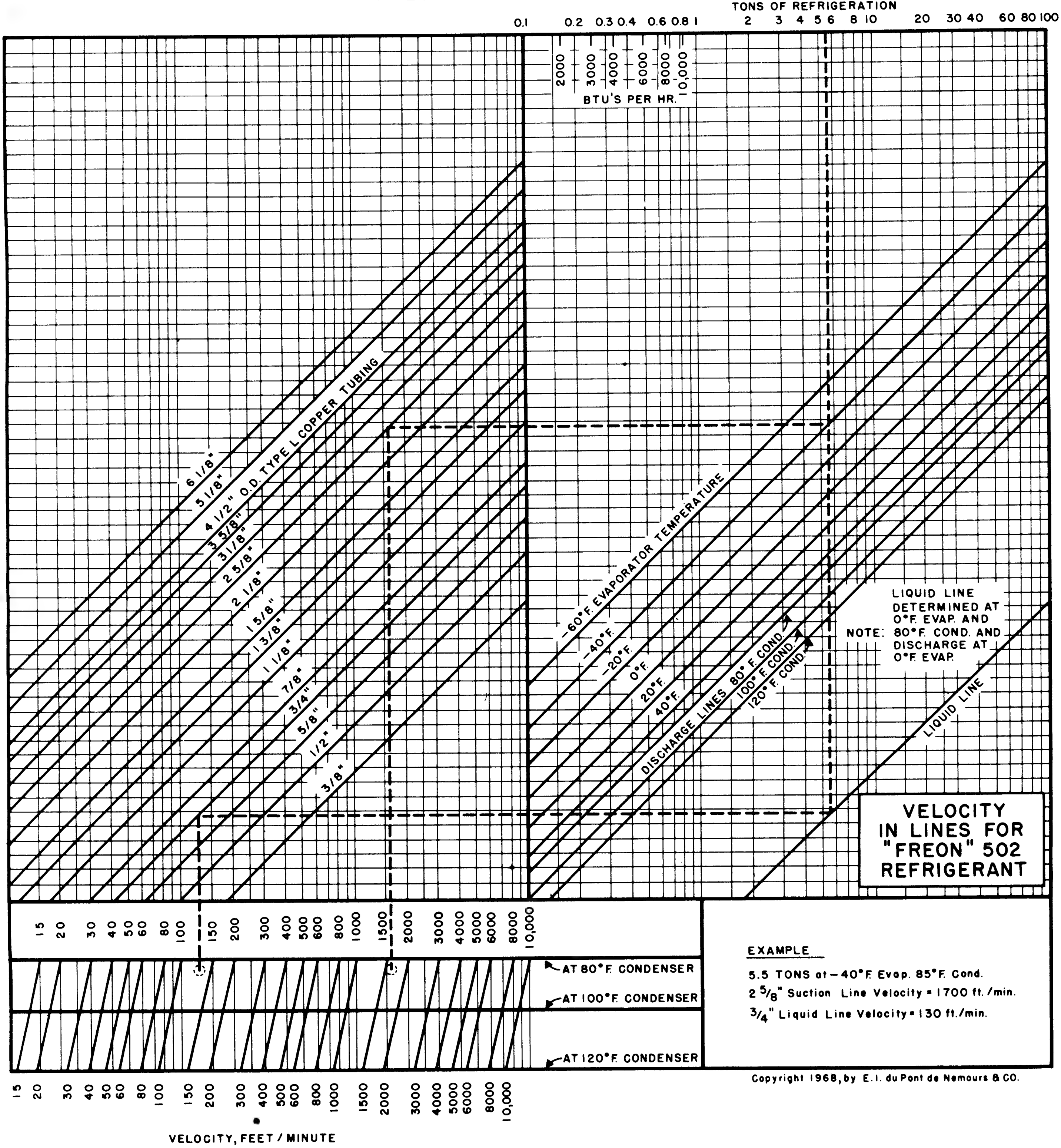
"FREON" 502 REFRIGERANT



EXAMPLE

5.5 TONS at −40°F. Evap. 85°F. Cond.

2 5/8" Suction Line Velocity = 1700 ft./min.

3/4" Liquid Line Velocity = 130 ft./min.

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System Cleanup After Burnout

Purpose:

The cleanup of a refrigeration system after a burnout of the hermetic motor compressor is a most important undertaking. The instructions of the original equipment manufacturer in this regard should be followed.

This recommendation is intended to provide guidance on the cleanup of Tecumseh compressor equipped systems in the absence of specific OEM suggestions and are to be considered the minimum requirements.

Introduction:

Under normal operating conditions, the refrigerant and oil mixture in a Tecumseh compressor is chemically very stable as attested by the millions of compressors operating for many years without problems. When an electrical short occurs in the compressor motor, however, the resulting high temperature arc causes a portion of the refrigerant/oil mixture to break down into carbonaceous sludge, a very corrosive acid, and water. These contaminants must be carefully removed otherwise even small residues will attack replacement compressor motors and cause failures.

Procedure:

The following procedure is effective only if the system is monitored after installation of the replacement compressor to insure that the cleanup is properly accomplished.

Step I—

Make sure a burnout has occurred.

A. Remove the wiring from the compressor terminals and check for ground between each terminal and the compressor housing.

B. Check for continuity between the common terminal (C) and run terminal (R) and between the common terminal (C) and start terminal (S). (Make sure the compressor is cool to the touch if it has internal overload.)

C. Check for shorts between winding turns in accordance with the resistance values given in the Tecumseh Service Data Book.

D. If an access port is available, sample the refrigerant for the characteristic acrid odor of a burnout. Warning—smell cautiously, the gas could be toxic and highly acid.

E. If the above steps check OK, look elsewhere for the trouble. The external electrical components are a good place to start.

Step II—

A. Blow the system charge, preferably in the liquid state, to a well ventilated outdoor location. Caution—avoid getting the refrigerant in the eyes or on the skin.

B. Remove the burned compressor. Use rubber gloves if there is any likelihood of contacting the oil or sludge.

Step III—

To facilitate subsequent steps, determine the type of burnout that occurred. If the discharge line shows no evidence of sludge and the suction stub is likewise clean, or perhaps has some light carbon deposits, the burnout occurred while the compressor was not rotating. Contaminants are, therefore, largely confined to the compressor housing and a single installation of liquid and suction line filter-driers will probably suffice to clean up the system.

If the sludge is evident in the discharge line (and very likely also found in the suction line) the compressor motor burned while running. Sludge and acid has been pumped throughout the system and several changes of the liquid and suction filter-driers will probably be necessary to cleanse the system.

Systems suffering running burnouts will also need the expansion device cleaned or replaced. If a heat pump, the four way valve should be replaced.

Step IV—

Correct the system fault that caused the burnout.

Step V—

A. Install the replacement compressor with new external electrical components (capacitors, relay, overload, etc. where applicable). Check the contacts of the starting control or contactor.

B. Install an oversized liquid line filter-drier.

C. Install a generously sized suction line filter-drier immediately upstream of the compressor. The drier when permanently installed in a clean system, or as initially installed in a dirty system, must have a pressure drop not more than that of Table I. Pressure taps must be supplied immediately before and after the suction filter-drier to permit the pressure drop to be measured.

D. If a suction line accumulator is present, it must be thoroughly flushed after a running burnout to remove any trapped sludge and thus prevent it from plugging the oil return hole. The filter-drier should be installed between the accumulator and the compressor.

In the case of a standing burn, the filter-drier may be installed upstream of the suction line accumulator, if desired.

Rubber refrigeration hoses are not satisfactory for temporarily hooking up the suction line filter-drier to the system since the acid quickly attacks the rubber and plastic.

Step VI—

Evacuate the system to less than 1000 microns, using a good vacuum pump and an accurate high vacuum gauge. Operate the pump at 1000 microns, or less, for several hours and then allow the system to stand for several additional hours to be sure the vacuum is maintained.

An alternate method of removing moisture and noncondensables from the system is:

A. Evacuate system to 29 inches vacuum. Break vacuum with refrigerant to be used for final charging of system and vapor charge to 35-50 lbs. gauge pressure. Leave vapor charge in system for a minimum of five minutes. Reduce pressure to zero gauge pressure.
B. Repeat step A.
C. Evacuate system to 29 inches vacuum. Charge system with the specified kind and quantity of refrigerant.

NOTE: At no time use the compressor to evacuate the system or any part of it.

Step VII—

Charge the system and place in operation. Immediately after startup, check the pressure drop across the suction line filter-drier. This will serve two purposes:

1. Verify that the drier selection was correct; that is, large enough.
2. Serve as a base point to which subsequent pressure checks can be compared.

Because the permissible pressure drop across the drier is relatively small, it is suggested that a differential pressure gauge be used for the measurement.

Step VIII—

After the system has been operating for an hour or so, measure the pressure drop across the suction line filter-drier.

In the case of the cleanup of a standing burnout, little change should be noted. The pressure drop will, in most instances, be below that tolerable for a permanent installation. See Table I.

On the other hand, where a severe running burnout has occurred, an increased pressure drop will be measured. Change the suction filter-drier *and* the liquid line filter-drier whenever the pressure drop approaches or exceeds that allowed for temporary operation during cleanup. See Table II.

Keep changing both the suction and liquid line filter-driers until the pressure drop stabilizes at a figure equal to or below that permitted for permanent operation in a system. See Table I. At this point, it is the serviceman's option as to whether to leave the suction drier in the system or remove it from operation.

If the system is to be opened to permit the permanent removal of the suction filter-drier then the liquid line filter-drier should be changed once more.

Table I

Suggested Maximum Pressure Drop (PSI) for Permanent Suction Filter-Drier Installation

Application	*Air Cond.*	*High*	*Medium*	*Low*	*Low*
Evaporator Range, °F	+55 to +32	+55 to +20	+30 to −10	+10 to −20	−20 to −40
R-12	2	2	1½	½	½
R-22	3	3	2	1	½
R-502	3	3	2	1	½

Table II

Suggested Maximum Pressure Drop (PSI) for Temporary Suction Filter-Drier Installation during Cleanup

Application	*Air Cond.*	*High*	*Medium*	*Low*	*Low*
Evaporator Range, °F	+55 to +32	+55 to +20	+30 to −10	+10 to −20	−20 to −40
R-12	9	9	6	2	¾
R-22	15	15	9	3	1½
R-502	15	15	9	3	1½

Step IX—

If the system has suffered multiple burnouts, it is advisable that the oil of the replacement be tested after Step VIII and judged acid free before the system is considered satisfactorily cleaned.

An oil sample may be taken from a hermetic system if at the time the replacement compressor was installed an oil trap is installed in the suction line. See Sketch A. Note that this port, if immediately downstream of the drier, can also be used for making the pressure drop checks across the filter-drier.

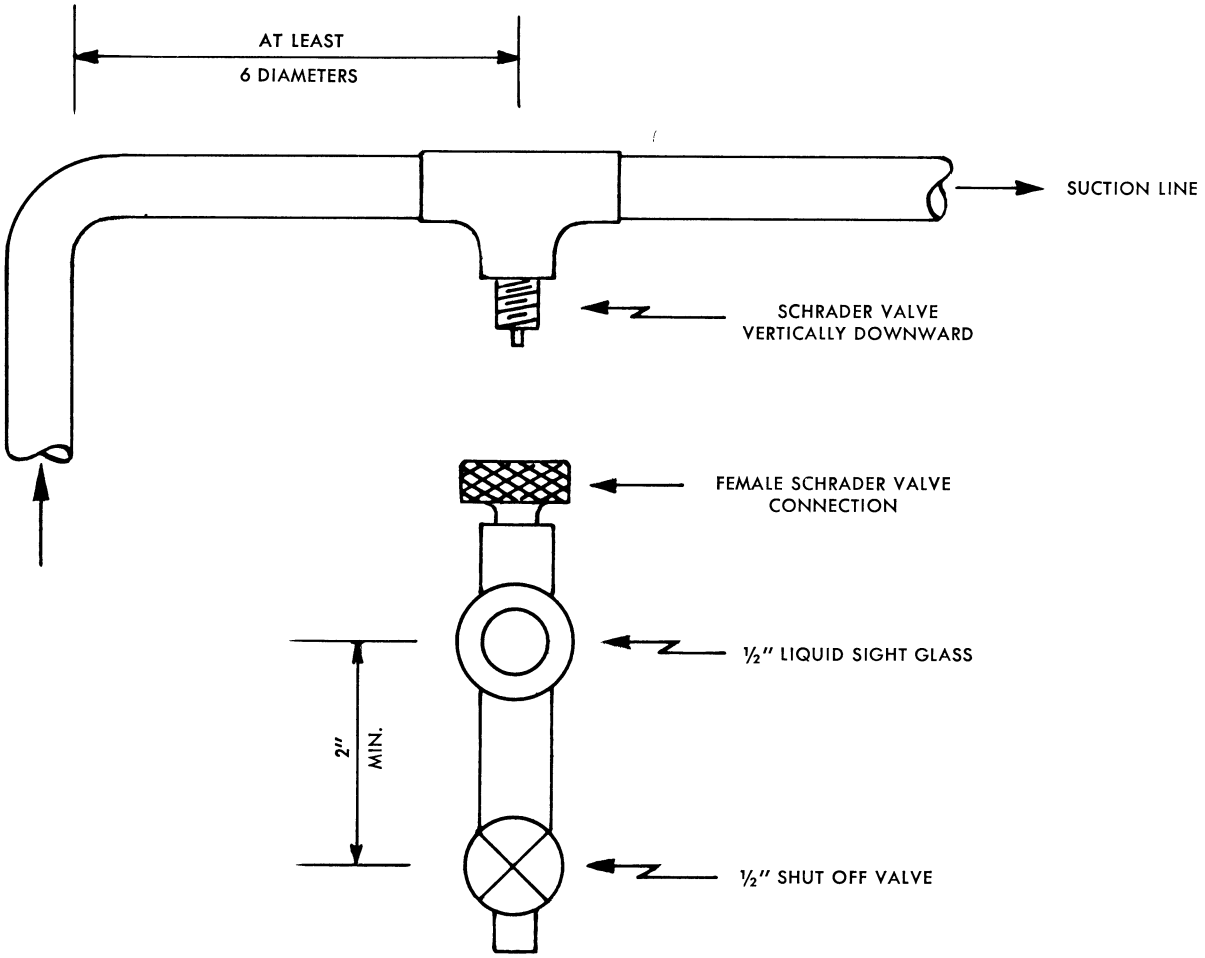
When the trapped oil level appears in the sight glass (less than an ounce is needed) the oil may be *slowly* transferred to the beaker of the acid test kit as available from several manufacturers. A reading of less than 0.05 acid number is an indication that the system is free of acid.

A reading higher than 0.05 means continued cleanup is required. Return to step VB.

Conclusion:

The above procedure for the cleanup of hermetic systems after burnout through the use of suction line filter-drier will prove satisfactory in most instances *provided* the system is monitored and kept clean by repeated drier changes, if such are needed. The failure to follow these *minimum cleanup recommendations* will result in an excessive risk of a repeat burnout.

SKETCH A



Method of obtaining oil sample on hermetic system.

After satisfactory oil test, Schrader valve may be capped and the oil sampler taken to next job.

A LOOK AT SERVICE SAFETY

We live in a wonderful world of products that promote health, comfort and convenience.

Safety in producing, installing, and maintaining these products is vital to everyone's business.

Tecumseh Products Company has prepared this safety outline in the interest of encouraging a greater awareness of safe practices throughout the refrigeration and air conditioning industry.

Properly handled compressed gases are vital tools to the refrigeration and air conditioning industry.

Unfortunately, improperly applied compressed gases account for a high percentage of those accidents which do occur.

Special attention is called to the proper precautionary procedures necessary in the safe handling of gases for testing, system cleaning, and system charging.

Oxygen-Acetylene

Oxygen, or acetylene, must never be used to pressurize any refrigeration or air conditioning system.

Oxygen will explode on contact with oil.

Acetylene will explode under pressure except when properly dissolved in acetone as used in commercial acetylene cylinders.

Nitrogen-Carbon Dioxide

Dry nitrogen or dry carbon dioxide are suitable gases for pressurizing refrigeration and air conditioning systems for leak tests or system cleaning—providing specific precautions are strictly followed:

Nitrogen—(N_2)
Commercial cylinders contain pressures in excess of *2000 lb. per square inch* at normal room temperature.

Carbon Dioxide—(CO_2)
Commercial cylinders contain pressures in excess of *800 lb. per square inch* at normal room temperature.

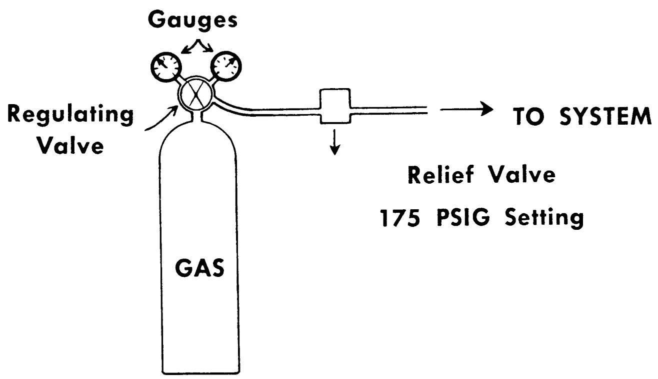
Cylinders should be handled carefully.
Do not drop or bump.
Keep in vertical position securely fastened to prevent tipping over.
Do not heat cylinder with torch or other open flame.
If heat is necessary to withdraw gas from cylinder, heat by immersing lower portion of cylinder in warm water. Never heat a cylinder over 110° F.

Pressure testing or pressure cleaning refrigeration and air conditioning systems can be dangerous! Extreme caution must be employed in the selection and use of pressurizing equipment.

Never attempt to pressurize a system without first installing an appropriate pressure regulating valve on the nitrogen or carbon dioxide cylinder discharge. This regulating valve should be equipped with two functioning pressure gauges. One indicating cylinder pressure and the other indicating discharge or downstream pressure.

Always install a pressure relief valve or frangible disc type pressure relief device in the pressure supply line. This device should have a discharge port of at least ½" MPT size. This valve or frangible disc device should be set to release at 175 PSIG.

System can now be pressurized up to a maximum of 150 PSIG for leak testing or purging.*



*** Tecumseh hermetic type compressors are low pressure housing compressors. The compressor housings (cans or domes) are not normally subjected to discharge pressures—operating instead of relatively low suction pressures. These Tecumseh compressors are generally installed on equipment where it is impractical to disconnect or isolate the compressor from the system during pressure testing; therefore, do not exceed 150 PSIG when pressurizing such a complete system.**

When flushing or purging a contaminated system, care should be taken to protect the eyes and skin from contact with acid-saturated refrigerant or oil mists.

In the event that contact with either skin or eyes occurs—flush exposed area with cold water, apply ice pack if severe burn, and see a physician at once.

Refrigerant (R-12 and R-22) Precautions

Refrigerants 12 and 22 are generally considered to be chemically non-toxic and non-inflammable; however, any gas under pressure can be hazardous because of the energy latent in the pressure alone. Therefore, observe all cylinder handling rules listed on page 2.

Never fill any refrigerant gas cylinder completely with liquid. Always limit to approximately 80% liquid full. This will allow for normal expansion.

When evacuating or purging any system containing R-12 or R-22 always ventilate the area immediately. R-12 or R-22 in certain concentrations and in the presence of open flames such as gas range or gas water heater pilot lights may break down and form small amounts of harmful phosgene gas.

A sudden release of refrigerant liquid sprayed on the skin can cause serious damage to skin tissue. Keep eyes and exposed skin areas away from any potential refrigerant discharge. If such a refrigerant burn occurs —flush immediately with cold water, apply ice packs if severe and see a physician at once.

Single Phase Compressor Crankcase Heating Off-Cycle Run Capacitor Type

This subject is included in this discussion because of the all too human failing of acting first and reading after.

Many Tecumseh single phase compressors are installed in systems requiring off-cycle crankcase heating designed to prevent refrigerant accumulation in the compressor housing.

A very popular system utilizes a run capacitor which is always connected to the compressor motor windings even when the compressor is not running.

Other equally common systems contain devices where power is also on even though compressor is not running.

Be Safe—Before attempting to service any refrigeration system make certain that main breaker is open and all power is off.

Lifting Heavy Objects Properly

Strains and sprains are often caused by improper methods of lifting.

Learn to lift the safe way in order to avoid injury.

Bend your knees, keep your back erect, and lift gradually with your leg muscles.

Remember that the material you are lifting may slip out of your hands. Protect your feet as much as possible by keeping them out of the way.

LIFTING

Trouble Shooting and Service Chart

	COMPLAINT	POSSIBLE CAUSE	REPAIR
A	Compressor will not start—no hum	1. Line disconnect switch open.	1. Close start or disconnect switch.
		2. Fuse removed or blown.	2. Replace fuse.
		3. Overload protector tripped.	3. Refer to electrical section.
		4. Control stuck in open position.	4. Repair or replace control.
		5. Control off due to cold location.	5. Relocate control.
		6. Wiring improper or loose.	6. Check wiring against diagram.
B	Compressor will not start—hums but trips on overload protector	1. Improperly wired.	1. Check wiring against diagram.
		2. Low voltage to unit.	2. Determine reason and correct.
		3. Starting capacitor defective	3. Determine reason and replace.
		4. Relay failing to close.	4. Determine reason and correct, replace if necessary.
		5. Compressor motor has a winding open or shorted.	5. Replace compressor.
		6. Internal mechanical trouble in compressor.	6. Replace compressor.
		7. Liquid refrigerant in compressor.	7. Add crankcase heater and/or accumulator.
C	Compressor starts, but does not switch off of start winding	1. Improperly wired.	1. Check wiring against diagram.
		2. Low voltage to unit.	2. Determine reason and correct.
		3. Relay failing to open.	3. Determine reason and correct, replace if necessary.
		4. Run capacitor defective.	4. Determine reason and replace.
		5. Excessively high discharge pressure.	5. Check discharge shut-off valve, possible overcharge, or insufficient cooling on condenser.
		6. Compressor motor has a winding open or shorted.	6. Replace compressor.
		7. Internal mechanical trouble in compressor (tight).	7. Replace compressor.
D	Compressor starts and runs, but short cycles on overload protector	1. Additional current passing through overload protector.	1. Check wiring diagram. Check for added fan motors, pumps, etc., connected to wrong side of protector.
		2. Low voltage to unit (or unbalanced if three phase).	2. Determine reason and correct.
		3. Overload protector defective.	3. Check current, replace protector.
		4. Run capacitor defective.	4. Determine reason and replace.
		5. Excessive discharge pressure.	5. Check ventilation, restrictions in cooling medium, restrictions in refrigeration system.
		6. Suction pressure too high.	6. Check for possibility of misapplication. Use stronger unit.
		7. Compressor too hot—return gas hot.	7. Check refrigerant charge (fix leak), add if necessary.
		8. Compressor motor has a winding shorted.	8. Replace compressor.
E	Unit runs OK, but short cycles on	1. Overload protector.	1. See D. above.
		2. Thermostat.	2. Differential set too close—widen.
		3. High pressure cut-out due to:	
		a. Insufficient air or water supply.	3a. Check air or water supply to condenser—correct.
		b. Overcharge.	3b. Reduce refrigerant charge.
		c. Air in system.	3c. Purge.
		4. Low pressure cut-out due to:	
		a. Liquid line solenoid leaking.	4a. Replace.
		b. Compressor valve leak.	4b. Replace.
		c. Undercharge.	4c. Fix leak, add refrigerant.
		d. Restriction in expansion device.	4d. Replace device.

Trouble Shooting and Service Chart

	COMPLAINT	POSSIBLE CAUSE	REPAIR
F	Unit operates long or continuously	1. Shortage of refrigerant.	1. Fix leak, add charge.
		2. Control contacts stuck or frozen closed.	2. Clean contacts or replace control.
		3. Refrigerated or air conditioned space has excessive load or poor insulation.	3. Determine fault and correct.
		4. System inadequate to handle load.	4. Replace with larger system.
		5. Evaporator coil iced.	5. Defrost.
		6. Restriction in refrigeration system.	6. Determine location and remove.
		7 Dirty condenser.	7. Clean condenser.
		8. Filter dirty.	8. Clean or replace.
G	Start capacitor open, shorted, or blown	1. Relay contacts not operating properly.	1. Clean contacts or replace relay if necessary.
		2. Prolonged operation on start cycle due to:	
		a. Low voltage to unit.	2a. Determine reason and correct.
		b. Improper relay.	2b. Replace.
		c. Starting load too high.	2c. Correct by using pump down arrangement if necessary.
		3. Excessive short cycling.	3. Determine reason for short cycling (E above) and correct.
		4. Improper capacitor.	4. Determine correct size & replace.
H	Run capacitor open, shorted, or blown	1. Improper capacitor.	1. Determine correct size and replace.
		2. Excessively high line voltage (110% of rated-max.).	2. Determine reason and correct.
I	Relay defective or burned out	1. Incorrect relay.	1. Check and replace.
		2. Incorrect mounting angle.	2. Remount relay in correct position.
		3. Line voltage too high or too low.	3. Determine reason and correct.
		4. Excessive short cycling.	4. Determine reason (See E above) and correct.
		5. Relay being influenced by loose vibrating mounting.	5. Remount rigidly.
		6. Incorrect run capacitor.	6. Replace with proper capacitor.
J	Space temperature too high	1. Control setting too high.	1. Reset control.
		2. Expansion valve too small.	2. Use larger valve.
		3. Cooling coils too small.	3. Add surface or replace.
		4. Inadequate air circulation.	4. Improve air movement.
K	Suction line frosted or sweating	1. Expansion valve passing excess refrigerant or is oversized.	1. Readjust valve or replace with smaller valve.
		2. Expansion valve stuck open.	2. Clean valve of foreign particles, replace if necessary.
		3. Evaporator fan not running.	3. Determine reason and correct.
		4. Overcharge of refrigerant.	4. Correct charge.
L	Liquid line frosted or sweating	1. Restriction in dehydrator or strainer.	1. Replace part.
		2. Liquid shut-off (king valve) partially closed.	2. Open valve fully.
M	Unit noisy	1. Loose parts or mountings.	1. Find and tighten.
		2. Tubing rattle.	2. Reform to be free of contact.
		3. Bent fan blade causing vibration.	3. Replace blade.
		4. Fan motor bearings worn.	4. Replace motor.

The "Trouble Shooting and Service Chart" is quite self-expanatory; however, a discussion of some of the complaints, possible causes, and repair solutions may be of some additional assistance.

Complaint "A" is **Compressor will not start. No hum.**

Possible causes are—

1. *Switch open.* Rather obvious, but maybe it would be wise to determine why or who opened it.

2. *Fuse removed or blown.* Again, was there a reason?

3. *Overload protector tripped.* Here, too, it is not a case of waiting until the overload resets, but rather to determine why.

4. *Control stuck in open position.* Faulty contactors may be a cause, although every effort is made to provide the best quality contactors. And heed this warning: don't use the insulated end of a screwdriver to hold the contactor in. In doing so you run the risk of burning out a good compressor.

Complaint "B." **Compressor will not start—hums and trips on overload.**

1. & 2. have been discussed.

3. *Starting capacitor defective.* It says "determine reason." Possibly a start capacitor was installed which had too low a voltage rating.

4. *Relay failing to close.* Is the correct one being used? There seems to be a considerable tendency to substitute something other than the one specified—if it works leave it. We say, please don't do it.

5. *Compressor has a winding open or shorted.* The repair specified says simply "replace compressor." This means if the cause indicated has been proved —without doubt — conclusively —no question about it—only then replace the compressor. Remember that replacing the compressor is generally the most costly repair bill an owner can get. So be sure—first.

6. *Internal mechanical trouble in compressor.* If the serviceman has proved without question that none of the other possible causes are the reason for the condition, then and then only can it be mechanical trouble.

A "Trouble Shooting Chart" of this kind is not the entire answer. There are probably a number of other reasons for the cause of each "complaint" listed, so keep in mind that application of knowledge gained through experience and common sense are as much a part of trouble shooting as the use of any chart.

Complaint "C" is **Compressor starts but stays on run winding.**

How do you know this condition is occurring? If the amps stay higher than normal. Or if you don't hear the changeover.

1. through 3. Covered previously.

4. *Run capacitor defective.* If the run capacitor is failed closed, there will be a period of time when the current and running sounds will seem to indicate the relay has not switched. In a relatively short period of time, the start winding will burn, so time is of the essence in this case.

5. *High head pressure.* Be sure to check all the things listed in the "repair" column.

Complaint "D" is **Compressor starts and runs, but short cycles on overload protector.**

1. Mentioned before.

2. *Low voltage to unit (or unbalanced if three-phase).* In the matter of three-phase unbalance—this is an instance in which it is probably wise to call in the power company, or check with the building owner to determine what other equipment is on the source of power to cause the unbalance.

3. *Overload protector defective.* Sometimes difficult to determine. One good clue is how it looks—does it show to have been overheated?

6. *Suction pressure too high.* This will occur more often on refrigeration than air conditioning, especially on low temperature equipment.

7. *Compressor hot — insufficient gas cooling.* Usually a result of a low charge.

Most of the other complaints, causes, and repair suggestions are straightforward, and the best suggestion is to follow the chart.

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